Psychosocial predictors of alcohol consumption among undergraduate students: Developing intervention strategies

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Declaration

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature:……Date:…….

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Contents

Preface

This thesis is presented as a collection of manuscripts written for publication. Chapters 2-5 can be considered as standalone pieces of work. Chapter 1 provides a general overview of the relevant literature, and chapter 6 summarises the findings of the empirical work and relates these back to the previous research. Chapter 4 has been published in Alcohol and Alcoholism, and Chapters 2 and 5 are in the final stages of preparation for submission.

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Summary

Excessive alcohol consumption among UK university students is well documented. Although alcohol use reduces over the time spent at university, drinking patterns of undergraduates have been associated with risk of alcohol dependence and abuse a decade following graduation. Consequently, UK universities should endeavour to promote responsible drinking among their drinking student population.

This thesis presents four studies that aim to inform the development of feasible and effective alcohol-related interventions targeting the student population. The first two studies examined the effect of an alcohol-related outcome expectancy manipulation on alcohol-related cognitions and consumption. Study one showed that a manipulation aiming to bolster negative expectancies and contradict positive expectancies was associated with immediate reductions in mild desires for alcohol. Study two provided limited support for study one, and indicated that repeated exposure to the manipulation was not associated with significantly greater effects. Neither study showed significant reductions in alcohol consumption.

Study three used a survey to examine the predictive utility of a broader range of correlates of alcohol consumption, and provided an integrative model of risky drinking behaviour. The model highlighted the importance of age when first regularly drinking, the sensation-seeking personality trait, social drinking motives, confidence in ability to drink within government guidelines, and the perceived quantity and frequency of alcohol consumed by university friends.

Study four consisted of a systematic review and meta-analysis examining the effectiveness of computer-delivered interventions (CDIs) across different study design features and identified the characteristics of CDIs associated with the largest effects. CDI efficacy was greater for primary than secondary outcomes, and varied according to

the control condition and outcomes used. CDIs with the largest effects utilised personalised normative feedback among US heavy/binge drinking students.

The results of these studies contribute to the current intervention literature and can be used to inform intervention development in UK universities.

Chapter 1

General Introduction

Since 1995, the UK government has recommended that men should not regularly drink more than 3-4 units of alcohol per day and women should not regularly drink more than 2-3 units per day (House of Commons Science and Technology Committee, 2012). It is also recommended that alcohol be avoided for at least 48hrs after a heavy drinking session to allow the body time to recover. Regularly exceeding these guidelines can lead to long-term negative health consequences, including liver damage, various cancers, reduced fertility, high blood pressure, and heart attacks, and short-term consequences, including hangovers, weight gain, sexual problems, depression, fatigue, and sleep problems (National Health Service [NHS], 2012). In addition to personal consequences, alcohol-related harm is estimated to cost the UK approximately £12.6 billion per year, taking into account, healthcare, criminal and antisocial behaviour, and employee absenteeism (National Institute for Health and Care Excellence [NICE], 2010).

Current statistics indicate that 34% of men and 28% of women in the UK exceed guidelines (Office for National Statistics [ONS], 2013). Consequently, the government should develop and sustain appropriate alcohol-related policies and effective intervention strategies to promote responsible drinking among the population. In addition to population-level interventions, such as taxing alcohol sales and thereby raising prices, interventions aimed at specific groups known to engage in excessive consumption are needed. In particular, evidence-based interventions targeting the modifiable determinants of excessive alcohol consumption (Bartholomew, Parcel, Kok, & Gottlieb, 2011; Kok, Schaalma, Ruiter, Empelen, & Brug, 2004).

The advantages and disadvantages of population (or preventative) and high-risk (i.e., targeting those who are at-risk) research and intervention strategies are discussed by Rose (1985), and while he maintains that the two strategies are not in competition, the priority for health-related research should be to determine the underlying causes of incidence. Paradoxical patterns of alcohol-related harm indicate that it is the drinkers consuming lower levels of alcohol that contribute to the majority of harms (Weitzman & Nelson, 2004). This is because this group is larger in number. Consequently, preventative interventions may produce small benefits to each individual but greater benefits to the population, while interventions targeted at high-risk individuals may produce great benefits to the individual but smaller benefits to the population. Importantly, it is generally agreed that the two strategies be used in unison, and while population-level interventions may produce the greatest benefits, focusing on smaller at-risk groups may identify key determinants of alcohol consumption that might be applicable to the general population and may also allow researchers to investigate these determinants in greater depth.

1.1. Alcohol Use among UK Undergraduate Students: An At-Risk Population

A recent review of 18 studies has shown that students tend to consume a greater quantity of alcohol, drink more frequently, and are more at risk of alcohol-related problems than their non-student peers (Carter, Brandon, & Goldman, 2010). In addition to the aforementioned short- and long-term consequences of drinking experienced by the general population, excessive consumption may hinder academic performance at university (Singleton, 2007; Singleton & Wolfson, 2009). Perkins' (2002) narrative review indicates that 11-28% of students report missing class due to alcohol consumption. Moreover, experimental studies have demonstrated students' drinking behaviour to be associated with poorer verbal declarative memory (Parada et al., 2011),

and poorer performance on executive function tasks (Parada et al., 2012), which may contribute to lower grades. Students are also shown to report multiple negative consequences of their drinking, including hangovers, vomiting, blackouts, and risky sexual behaviour (e.g., Barnett et al., 2014; Foster, Caravelis, & Kopak, 2014). Many students report repeatedly experiencing these consequences (Mallett et al., 2011).

In addition to negative consequences of alcohol consumption, students also report many positive consequences (Park, 2004). Drinking is commonly associated with having fun, socialising, and expressing oneself (Lee, Maggs, Neighbors, & Patrick, 2011; Park, 2004). Holding positive expectations regarding the effects of alcohol, such as becoming more sociable, feeling more relaxed, or acting more confidently, tend to be associated with higher levels of alcohol consumption (Lewis & O'Neill, 2000; Palfai, Wood, & Brandon, 2001; Wardell & Read, 2013) and may be contributing to the number of students reporting excessive consumption.

Research in the UK has shown that exceeding the sensible weekly benchmarks (≥ 21 units per week for men, ≥ 14 units per week for women), which were replaced by the current daily government guidelines (e.g., House of Commons Science and Technology Committee, 2012), is common among undergraduate students (Craigs, Bewick, Gill, O'May, & Radley, 2011; Gill, 2002; Webb, Ashton, Kelly, & Kamali, 1996). A recent alcohol diary study by Craigs and colleagues (2011) demonstrated that 32% of students were shown to drink hazardous levels of alcohol (i.e., exceeded sensible weekly benchmarks) and 26% were shown to drink at harmful levels (i.e., ≥ 50 units per week for men, ≥ 35 units per week for women). Moreover, 73% of the respondents were shown to exceed the current recommended daily guidelines at least once per week.

The number of UK students reporting risky drinking behaviour is of great concern and has been demonstrated in a multi-site survey involving seven universities (Heather et al., 2011). According to scores on the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monterio, 2001), which takes into account alcohol-related behaviour in addition to quantity and frequency of alcohol consumed, Heather et al. (2011) found that 40% of students reported hazardous drinking behaviour, 11% reported harmful drinking, and 10% reported behaviour that may be indicative of dependence.

The AUDIT was developed as a result of a World Health Organisation (WHO) collaborative project involving six countries (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The 10-item questionnaire, designed as a simple screening tool for excessive alcohol consumption in primary health care, covers the domains of alcohol consumption, drinking behaviour, and alcohol-related problems. Each item yields a score between 0 and 4, with a possible total score of 40, which reflects, "level of risk related to alcohol" (Babor et al., 2001, p.19). Scores of ≥ 8 are considered to be a sensitive measure of problematic drinking behaviour (Babor et al., 2001). Although cut-off scores should be used tentatively and may vary between countries due to drinking patterns and alcohol content, scores of 8-15 are considered to indicate hazardous drinking that may warrant simple alcohol-related advice, 16-19 to indicate harmful drinking that would benefit from brief counselling and monitoring, and 20+ as a possible indictor of alcohol dependence, warranting further diagnostic evaluation.

The AUDIT has been shown to be a sensitive and reliable measure among various subgroups, including primary care patients (Allen, Reinert, & Volk, 2001), UK prisoners (MacAskill et al., 2011), depressed or anxious persons (Boschloo et al., 2010), and US students that have been mandated for drinking violations (O'Hare & Sherrer,

1999). Reviews of research conducted with the AUDIT have concluded that the questionnaire is effective in detecting hazardous drinking behaviour in various populations, and to a lesser extent, lifetime alcohol dependence (Allen, Litten, Fertig, & Babor, 1997). The AUDIT performs well when compared to other self-report measures of alcohol consumption (Reinert & Allen, 2002), and scores have been shown to correlate with biochemical measures of alcohol consumption (Allen et al., 1997).

The AUDIT has been used to assess alcohol use among the student population in numerous studies (e.g., Adewuya, 2005; Fleming, Barry, & MacDonald, 1991; Gajecki, Berman, Sinadinovic, Rosebdahl, & Andersson, 2014; Pohjola, Rannanautio, Kunttu, & Virtanen, 2014; Kokotailo et al., 2004; Lyvers, Basch, Duff, & Edwards, 2014), and has been shown to be more effective in identifying problematic drinking behaviour in this population than other alcohol measures (Lee, Kim, Jung, Choi, & Ryou, 2011).

Students' drinking is shown to decrease over the course of their degrees; first year students report consuming significantly more units of alcohol per week than second and third year students (Bewick et al., 2008). Drinking is also shown to vary throughout the academic year, seemingly as a product of workload and holidays (Del Boca, Darkes, Greenbaum, & Goldman, 2004). Typically, academic workload increases during the second and final year of UK undergraduate degrees. First year grades determine entry into second year but do not often contribute to final marks. Consequently, many first year students may experience less academic demand, which has been found to be associated with consumption (Tremblay et al., 2010; Wood, Sher, & Rutledge, 2007).

Although the decrease in alcohol consumption following the first year is encouraging, research indicates that heavy drinking during this time is associated with

future alcohol misuse. Longitudinal studies have found that heavy drinking behaviour during the college years predicts alcohol-use disorders ten years later (Jennison, 2004; O'Neill, Parra, & Sher, 2001). As such, despite considering heavy drinking at university to be a phase or time-out before the responsibilities of the "real world" (Colby, Colby, & Raymond, 2009), those engaging in repeated excessive consumption are at risk of laying the foundations for problematic consumption later in life.

Alcohol use in undergraduate students has been extensively examined. However, this research field is dominated by US studies. The US minimum drinking age of 21 years old (compared to 18 years old in the UK) means that US students have additional legal repercussions to consider when consuming alcohol. Federally funded US colleges/universities are also required to comply with the Drug-Free Schools and Communities Act (DFSCA) 1989 amendment, which states that higher education institutions, "must develop and implement a program to prevent the unlawful possession, use, or distribution of illicit drugs and alcohol by students" (United States Department of Education, 2006, p. 3). These legal differences mean that US universities must take a proactive approach to alcohol prevention. They also mean that alcohol consumption cultures in US and UK universities are likely to be different in many respects, questioning the generalizability of US findings to UK universities.

In the UK, where approximately 40% of 18 year olds attend university, the House of Commons Health Committee (2010) has emphasised universities' responsibilities, recommending that they, "take a much more active role in discouraging irresponsible drinking amongst students" (p. 21). US research may help inform an evidence-based approach to intervention development for UK students but it is important to continue developing an evidence-base using British students to aid intervention development among this population.

1.2. Preliminary Work

Prior to the completion of the four studies in this thesis, qualitative individual interviews were conducted with first and final year undergraduate students to examine the role of alcohol consumption in university integration and subsequent years. Although this work is not presented, the preliminary findings informed the development of the four studies comprising this thesis.

All first year students interviewed consumed alcohol. Interviews were conducted during the first term of university and many described particularly high levels of consumption during "fresher's fortnight", some recalling events associated with extreme drinking behaviour. Drinking alcohol was thought to enhance a night out, enabling students to behave in a way they wouldn't normally. Drinking games, pre-drinking, and parties held in university residences were common and associated with high levels of consumption. Final year students tended to describe reduced frequency of drinking over the year, often as a result of academic demands or financial consequences. The interviews corresponded to previously published studies in portraying a group of first year students who regularly consume alcohol well in excess of current health-protective guidelines.

Most students described positive expectations that facilitated social functioning. Specifically, many associated alcohol with increased sociability and confidence; alcohol was seen as a catalyst in forming the new friendships with flat mates and other students that aided their integration. In contrast, non-drinkers were seen as a minority who were socially isolated. In the subsequent years of university, alcohol was deemed as playing a less important role in university life but was still associated with making and maintaining social relationships.

These preliminary findings positioned alcohol as a focal point in university life, particularly for first year students who felt that drinking enabled them to belong socially. Using alcohol to enhance a night-out with friends, and alcohol-related expectancies relating to increased sociability and confidence were particularly prominent themes.

1.3. Drinking Motives and Expectancies

The association between alcohol and socialising expressed by participants in the preliminary study supports many published qualitative studies that have provided similar examples of discourse with young people (e.g., de Visser, Wheeler, Abraham, & Smith, 2013; Fry, 2010; Harrison, Kelly, Lindsay, Advocat, & Hickey, 2011). In general, findings indicate that drinking is widely discussed as helping in the bonding process, giving drinking cliques a sense of camaraderie, and that drunken behaviour can provide amusing stories to be recollected at a later point in time.

Such qualitative discourse regarding the expected effects of alcohol can be linked to the quantitative constructs of drinking motives (e.g., Cooper, 1994) and alcohol-related expectancies (e.g., Fromme, Stroot, & Kaplan, 1993). Cooper (1994) developed a four-factor model of drinking motives among adolescents based on the earlier conceptual work of Cox and Klinger (1988; 1990). According to Cooper's (1994) model, four drinking motives are related to distinct patterns of antecedents and drinking-related outcomes. Social drinking motives (i.e., drinking to obtain positive social rewards) were positively correlated with quantity and frequency measures of alcohol consumption and drinking in celebratory settings. Coping drinking motives (i.e., drinking to reduce negative emotion) were positively associated with solitary drinking and alcohol-related problems. Enhancement drinking motives (i.e., drinking to enhance mood) were positively associated with heavy drinking. Finally, conformity drinking

motives (i.e., drinking to avoid social rejection) were associated with a pattern of light and infrequent drinking but also drinking-related problems. This model has been replicated and validated among adolescents in Switzerland (Kuntsche, Knibbe, Gmel, & Engels, 2006), and a US university sample (MacLean & Lecci, 2000).

Drinking motives can be considered as proximal predictors of alcohol consumption that reflect distal expectancies of alcohol effects. For example, if an individual is motivated to drink for social reasons, they must expect alcohol to influence their sociability. In fact, a number of studies have shown that drinking motives mediate the relationship between drinking behaviour and alcohol-related outcome expectancies (Engels, Wiers, Lemmers, & Overbeek, 2005; Kuntsche, Knibbe, Engels, & Gmel, 2007). Fromme and colleagues (1993) developed a questionnaire that measures four positive and three negative expected effects of alcohol. The positive alcohol-related expectancies include sociability (i.e., I expect to be more sociable when I drink alcohol), tension reduction (i.e., I expect to feel relaxed when I drink alcohol), liquid courage (i.e., I expect to be more courageous when I drink alcohol), and sexuality (i.e., I expect to be more sexual when I drink alcohol). The negative alcohol-related expectancies include cognitive and behavioural impairment (i.e., I expect my thoughts and behaviour to be impaired when I drink alcohol), risk and aggression (i.e., I expect to take more risks and act more aggressively when I drink alcohol), and self-perception (i.e., I expect to think negatively when I drink alcohol). This questionnaire has been used and validated among university student samples (e.g., Johnson & Fromme, 1994; McKee, Hinson, Wall, & Spriel, 1998; Valdivia & Stewart, 2005).

1.4. Using Research to Enhance Behaviour Change Intervention Development

Different types of research can be used to inform different areas of alcohol intervention development. For example, in their description of the intervention-mapping

(IM) framework (see Figure 1), Kok and colleagues (2004) highlight several areas in the intervention development process that may be logically affiliated with different research methodologies. Three of these research methodologies are utilised within this thesis. First, experimental laboratory-based studies can be used to assess the efficacy of behaviour change techniques that aim to modify specific determinants of alcohol use. Second, survey designs can be used to examine predictors of alcohol use and identify the key stable and potentially modifiable correlates. Third, evaluating previous research within systematic reviews and meta-analyses can be used to establish the overall effectiveness of previously examined interventions and identify moderators of such efficacy.

1.5. Modifying Determinants of Student Alcohol Use

Laboratory-based experiments enable the researcher to establish greater control over the confounding variables of a naturalistic setting and infer cause and effect. Consequently, this research approach can be used to examine underlying mechanisms of alcohol use and investigate the effects of applying mechanism-linked change techniques. Experimental findings can inform evidence-based intervention development. Specifically, experiments can establish the effectiveness of practical strategies to modify theory-based predictors of alcohol consumption.

Alcohol-related outcome expectancies were a prominent theme in the preliminary interviews described above and may be amenable to change through experimental manipulation. Through learned associations between alcohol and the subsequent positive and negative consequences, individuals begin to expect certain emotional or behavioural consequences of their future drinking. These expectancies are considered to have differential roles in influencing drinking behaviour. Positive alcohol-related expectancies are thought to initiate consumption, while negative expectancies

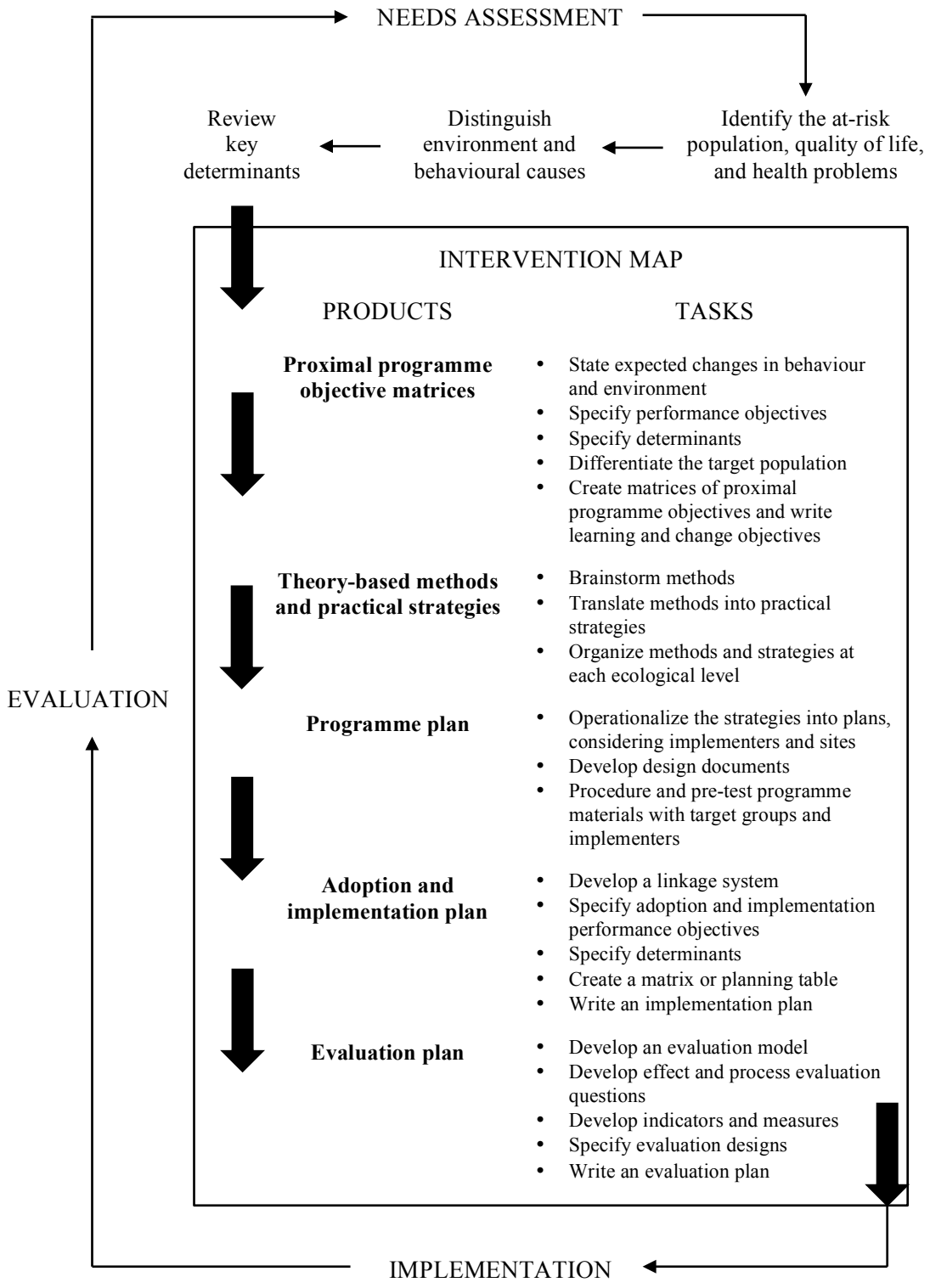

Figure 1. Intervention-mapping process (Kok et al., 2004).

are thought to restrain consumption (Lee, Greely, & Oei, 1999; McMahon, Jones, & O'Donnell, 1994). Positive expectancies are also suggested as playing a role in cognitive concepts of craving (e.g., Tiffany, 1999). Drug-related cues are thought to activate positive expectancies and generate craving.

Although expectancies have received extensive attention in alcohol-related research (e.g., Jones, Corbin, & Fromme, 2001), there are limitations that need to be addressed. First, despite the established relationship between positive and negative alcohol-related expectancies and alcohol consumption (Lee et al., 1999; McMahon et al., 1994; Nicolai, Moshagen, & Demmel, 2012; Satre & Knight, 2001), negative outcome expectancies have been relatively neglected in research (Adams & McNeil, 1991; Jones et al., 2001). Second, previous studies challenging positive alcohol-related expectancies have shown limited success in reducing alcohol consumption (Jones, 2004), which may be due to a lack of experimental control.

1.6. Identifying Key Determinants of Student Alcohol Use

Cross-sectional surveys are used to examine the direction and strength of the relationship between potential predictors and past or typical alcohol use. Although no cause and effect relationship can be inferred, such research is useful for identifying the key factors associated with alcohol consumption behaviour. These findings may be used to determine which components should be targeted within intervention strategies.

A number of reviews have compiled the evidence of stable and potentially modifiable psychosocial predictors of alcohol consumption in young adults (Courtney & Polich, 2009; Kuntsche et al., 2006) and students (Baer, 2002; Berkowitz & Perkins, 1986; Brennan, Walfish, & Aubuchon, 1986; Ham & Hope, 2003). Stable predictors, such as personality traits, age at onset of regular drinking, and religiosity, are not amenable to change but can be used to target interventions. Potentially modifiable

psychosocial predictors, such as motives, outcome expectancies, and self-efficacy, may be manipulated through intervention.

Although previous reviews help to identify potentially modifiable determinants of alcohol consumption, a number of limitations should be considered. First, with the dominance of US-based studies, it is important that the relevance of these determinants be examined with UK student samples. Second, the evidence of such reviews is compiled from a myriad of separate (sometimes heterogeneous) studies. As a result, it would be useful to examine the relative efficacy of each determinant within a single at-risk sample.

1.7. Reviewing Existing Alcohol-Reduction Interventions among Students

Systematic literature reviews and meta-analyses enable researchers to examine the overall efficacy of previously examined interventions. Such an approach can combine the findings of a number of studies to draw general conclusions regarding efficacy and the potential moderators of such efficacy, such as sample and study design characteristics. Consequently, meta-analyses can provide rich information for intervention development regarding previous intervention effectiveness.

Alcohol-related interventions among student populations have been synthesised within previously published reviews (e.g., Larimer, Cronce, Lee, & Kilmer, 2004; Moreira, Smith, & Foxcroft, 2009; Walters & Neighbors, 2005; White, 2006). These interventions, mainly tested on US students, vary greatly in design. For example, some interventions use university wide approaches (e.g., Bewick, Trusler, Mulhern, Barkham, & Hill, 2008), while others target specific at-risk groups within the student population (e.g., Carey, Henson, Carey, & Maisto, 2009; Larimer et al., 2001; Turrisi et al., 2009), some use no-contact approaches such as multi-component computer-based programs (e.g., Bersamin, Paschall, Fearnow-Kenney, & Wyrick, 2007), while others use face-to-

face delivery such as brief motivational interviewing (e.g., Borsari & Carey, 2000) or group-based interventions that challenge alcohol-related expectancies (e.g., Wiers & Kummeling, 2004). So, which approach might work best in UK universities?

If effective, computer-delivered interventions (CDIs) could offer a more cost-effective approach to alcohol intervention than face-to-face delivery with a clinician or therapist, and have a number of advantages in terms of anonymity, flexibility, and the ability to reach large audiences (Rhodes, Bowie, & Hergenrather, 2003; Ritterband et al., 2003; Taylor & Luce, 2003). First, at-risk drinking and treatment seeking have been shown to be associated with high levels of perceived stigma (e.g., Fortney et al., 2004; Corrigan et al., 2005; Schomerus et al., 2010). CDIs can offer a low-stigma approach by ensuring true anonymity to participants. Second, participants can experience greater flexibility by completing tasks or reading materials at their own convenience, and researchers still have the flexibility to provide interactive and tailored material (e.g., Lustria, Cortese, Noar, & Glueckauf, 2009; Portnoy, Scott-Sheldon, Johnson, & Carey, 2008). Third, once an effective CDI has been developed, it can be distributed to large numbers of participants at a low cost, when compared to paying for additional therapist or clinician face-to-face sessions. Reviews of CDIs may be helpful in considering future prevention of irresponsible alcohol use in UK universities. However, the research evaluating this intervention approach is not without its limitations.

1.8. Thesis Overview

This thesis reports the findings of four studies designed to inform alcohol-related intervention development among UK university students. Three research approaches were used. First, studies one and two report laboratory-based experiments designed to test change techniques that aim to modify previously identified psychosocial determinants of student alcohol consumption. This work can inform the

selection of strategies and methods used within interventions. Second, study three reports a cross-sectional survey designed to examine the relative predictive utility of previously identified stable and potentially modifiable psychosocial determinants. This work serves to prioritise intervention target strategies by identifying change targets and techniques that need to be tested. Third, study four reports a systematic review and meta-analysis that examines the efficacy of alcohol-related CDIs among student populations and investigate which outcome measures, target groups, and contexts affect observed CDI effectiveness.

Study 1 used a single-session laboratory study to examine the effects of a positive and negative script-driven alcohol-related outcome expectancy imagery manipulation on craving, outcome expectancies, and alcohol consumption. Imagery-script manipulations have been used to successfully alter alcohol-related craving (e.g., Tiffany & Drobes, 1990) and consist of asking participants to listen and imagine themselves in a situation presented by a narrative passage (which is designed to manipulate targeted cognitions). A positive imagery script aimed to bolster positive expectancies, and a negative imagery script aimed to bolster negative expectancies and contradict positive expectancies. In addition to manipulation effects, the evidence for the role of outcome expectancies in cognitive models of craving was considered, which in turn, may be associated with alcohol consumption.

Findings provided support for the role of expectancies in cognitive models of craving. However, there was limited evidence for the association between craving ratings and alcohol consumption. The negative imagery script manipulation was associated with reduced craving but not subsequent alcohol consumption. Furthermore, participants in the negative condition showed higher perceived loss of control over limiting their drinking after consuming alcohol during a taste-test.

Study 2 aimed to replicate and extend the results of study one by using repeated exposure to the negative imagery script manipulation, targeting students with particularly high positive expectancies and low negative expectancies, and using daily drinking diaries to measure consumption. The study examined the effects of the manipulation on craving, outcome expectancies, mood, attentional bias, positive and negative expectancy-related implicit associations, and alcohol consumption.

Descriptive statistics indicated that the negative script manipulation was associated with immediate reductions in craving ratings and changes in outcome expectancies in the expected direction following repeated exposure. However, the observed effects were small and failed to reach statistical significance. Furthermore, no significant effects were observed for the remaining alcohol-related measures or alcohol consumption. Consequently, these findings provided limited support for the results of study one, and indicated that repeated exposure to the manipulation and targeting individuals with at-risk expectancies was not associated with significantly greater effects than the use of a single-session manipulation that included students with varying beliefs regarding the effects of alcohol.

Study 3 used a cross-sectional survey design to examine the association between level of risk related to alcohol consumption, as measured by the AUDIT (Babor et al., 2001), and a range of stable and potentially modifiable psychosocial determinants identified in previous literature. The AUDIT has been used to categorise students into risk levels (i.e., hazardous drinker, harmful drinker, or possibly alcohol dependent; e.g., Heather et al., 2011) and to determine eligibility above a certain cut-off score (e.g., ≥ 8; Kypri et al., 2004). For the purposes of this study, the AUDIT was used as a continuous measure of level of risk associated with alcohol consumption, with higher scores indicating higher levels of risk. Stable determinants included age at onset,

personality traits, and religiosity, and potentially modifiable psychosocial determinants included drinking motives, self-efficacy, alcohol-related outcome expectancies, prototype perceptions, and normative beliefs. Findings were also used to provide an integrative model that predicts level of risk associated with alcohol consumption.

Results highlighted the importance of the age at onset (i.e., the age which an individual began regularly drinking alcohol), the sensation-seeking personality trait (characterised by adventure and thrill seeking, disinhibition, susceptibility to boredom etc.), social drinking motives (i.e., drinking to enhance/facilitate social interactions), self-efficacy (i.e., confidence in the ability to moderate alcohol consumption), and the perceived quantity and frequency of alcohol consumed by university friends. Self-efficacy and social drinking motives were particularly useful predictors. A significant interaction between age at onset and self-efficacy suggests that earlier onset is associated with lower levels of self-efficacy, and that lower levels of self-efficacy are associated with higher levels of alcohol consumption.

Study 4 employed a systematic review and meta-analysis to review the effectiveness of CDIs among students, and to examine how efficacy differed according to the control comparison condition and alcohol-related outcome measures used. Other potential moderators including country, year of study, drinker status, and intervention type were also examined.

Findings indicated that CDIs have a significant but very low and heterogeneous overall effect size. Effects were shown to vary according to the control condition and outcomes used. The CDIs associated with the largest effects were performed in the US and utilised personalised normative feedback among heavy/binge drinking students.

Chapter 2

Alcohol-related outcome expectancies and craving: Short-term effects of an expectancy manipulation on craving and alcohol consumption

2.1. Abstract

Cognitive models of craving suggest that drug-related cues may activate positive alcohol-related outcome expectancies regarding drug effects and generate craving. This study examined the relationship between expectancies, craving, and alcohol consumption, and investigated the effects of an imagery-driven expectancy manipulation. Sixty undergraduate students were randomly allocated to a positive, negative, or neutral expectancy manipulation (n = 20/group). As predicted, higher positive outcome expectancy ratings were shown to have a positive relationship with craving ratings and alcohol consumption measures. The negative manipulation, which bolstered negative outcome expectancies and contradicted positive outcome expectancies, was associated with lower mild desires craving ratings. However, participants in the negative condition also showed higher perceived loss of control over limiting their drinking following the consumption of alcohol in a taste-test. These findings indicate that positive alcohol-related outcome expectancies predict desires to drink and alcohol consumption. Bolstering negative expectancies and contradicting positive expectancies can reduce craving but may potentiate feelings of loss of control over alcohol consumption following an alcoholic beverage. These findings contribute to our understanding of craving and provide information regarding the use of negative expectancy imagery in alcohol-reduction interventions.

2.2. Introduction

Craving is an ambiguous concept (Sitharthan, McGrath, Sitharthan, & Saunders, 1992) and researchers have used varying definitions to encapsulate its meaning (Mezinskis, Honos-Webb, Kropp, & Somoza, 2001). For example, it has been defined in terms of the subjective experience; as an intense "wanting" (Robinson & Berridge, 1993, p.248) and more broadly, in terms of "subjective, behavioural, physiological, and neurochemical correlates" (Markou et al., 1993, pg.176). Nevertheless, craving is posited as having an important role in understanding addictive behaviour and relapse (e.g., Addolorato, Leggio, Abenavoli, & Gasbarrini, 2005; Flannery et al., 2001). For example, self-reported craving ratings have been associated with alcohol use disorder symptoms (MacKillop et al., 2010), alcohol consumption following treatment (Litt, Cooney, & Morse, 2000), and differentiating between problem drinkers (i.e., individuals that usually drank ≥ 2 drinks per day and met ≥ 1 criterion of alcohol abuse) and occasional drinkers (i.e., usually drank ≤ 1 drink per day and did not meet any criteria of alcohol abuse; Grüsser, Moersen, & Flor, 2006).

Craving models can be divided into traditional models based on classical conditioning and cognitive models that encompass cognitive responses to drug-related cues (Anton, 1999; Tiffany, 1999). According to the classical conditioning model, the repeated pairing of alcohol-related cues (e.g., pub/bar environment) and alcohol consumption would lead the paired cues to elicit similar physiological and psychological responses as drinking (i.e., become conditioned stimuli). In the absence of alcohol, the cue-related responses would result in craving. Conversely, cognitive models assume that individuals have a cognitive reaction to alcohol and alcohol-related cues, such as expectations regarding the effects of drinking, which may lead to craving. The outcome-expectancy model described by Tiffany (1999) originates from Marlatt's

cognitive-behavioural model of relapse prevention (see Larimer, Palmer, & Marlatt, 1999; Marlatt & Gordon, 1985) and suggests that drug-related cues may activate positive expectations about drug effects and generate craving.

Positive alcohol-related outcome expectations may cover a range of beliefs that individuals hold regarding the effects of drinking. For example, Fromme, Stroot, and Kaplan (1993) developed an expectancy questionnaire that measures four positive alcohol-related expectancies; sociability (e.g., "If I were under the influence of alcohol, it would be easier to talk to people"), liquid courage (e.g., "If I were under the influence of alcohol, I would feel brave and daring"), sexuality (e.g., "If I were under the influence of alcohol, I would feel sexy"), and tension reduction (e.g., "If I were under the influence of alcohol, I would feel calm").

The relationship between positive expectancies and craving has been demonstrated using an alcohol-related cue (i.e., holding and smelling their favourite alcoholic beverage) in alcoholics and non-alcoholics (Cooney, Gillespie, Baker, & Kaplan, 1987). Manipulating positive expectancies and examining the effect on craving can provide further evidence for the outcome-expectancy model. Previous studies have primed participants with expectancy-related words (Stein, Goldman, & Del Boca, 2000) or task information (Sharkansky & Finn, 1998) and used prevention programmes that challenge expectancies (Darkes & Goldman, 1993). However, these studies tend to examine the effect of the manipulation on alcohol consumption rather than craving, and although they have shown promising results for altering alcohol consumption in the expected direction, the literature is confounded with inconsistent effects (see Jones, Corbin, & Fromme, 2001).

One explanation for the inconsistencies in previous literature may be a lack of experimental control in some paradigms. For example, expectancy-challenge

interventions (e.g., Darkes & Goldman, 1993) typically target sexual and/or social expectancies in a group scenario. Participants are given an alcoholic beverage or placebo and asked to engage in a social (e.g., playing a game) or sexual situation (e.g., rating attractiveness) with peers. Participants are then asked to identify the drinkers in the group and errors are highlighted to prompt a discussion of expectancies. Success of the intervention relies on group interaction and the behaviour of non-drinkers to trigger others' alcohol-related expectancy schemata. An alternative, controlled method of challenging alcohol expectancies could involve the use of imagery scripts.

Imagery scripts are narrative passages of text that can be used to guide participants into imagining themselves in a given scenario. The scenarios can be designed to manipulate cognitions such as craving and affective state (e.g., "You're sitting in a reception, nervously waiting for an appointment. You're dreading this meeting and things aren't being helped by the fact that you've been trying not to smoke cigarettes over the past couple of days," Tiffany & Drobes, 1990, p.533). To date, guided imagery procedures have been used to increase craving in cigarette smokers (Tiffany & Drobes, 1990; Erblich, Montgomery, & Bovbjerg, 2009), alcohol-dependent men (Weinstein, Lingford-Hughes, Martinez-Raga, & Marshall, 1998), cocaine-dependent women (Kilts, Gross, Ely, & Drexler, 2004), and marijuana smokers (Singleton, Trotman, Zavahir, Taylor, & Heishman, 2002). This method has not been used previously to directly manipulate expectancies. However, urge-related scripts have encompassed a positive expectancy component (Weinstein et al., 1998).

Negative alcohol-related outcome expectancies, which may include cognitive and behavioural impairments (e.g., "If I were under the influence of alcohol, I would have difficulty thinking"), risk and aggression (e.g., "If I were under the influence of alcohol, I would take risks"), and self-perception (e.g., "If I were under the influence of

alcohol, I would feel guilty"; Fromme et al., 1993), have been less extensively examined than positive expectancies (Adams & McNeil, 1991; Jones et al., 2001) but shown to predict abstinence following treatment (Jones & McMahon, 1994) and lower consumption in social drinkers (Lee, Greely, & Oei, 1999; Nicolai, Moshagen, & Demmel, 2012). Consequently, the relationships between negative expectancies, craving, and alcohol consumption should be investigated.

In addition to the core beliefs that an individual holds, outcome expectancies reflect positive and negative affective state (Stein et al., 2000). Mood has been associated with craving (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Litt, Cooney, Kadden, & Gaupp, 1990; Willner, Field, Pitts, & Reeve, 1998) and alcohol consumption (Stein et al., 2000). As such, it is important to determine whether the expectancy-craving relationship may be attributable to affective state.

The current study examined craving, expectancies, and alcohol consumption among heavy drinking first year undergraduate students. Undergraduate students are a risk group for excessive alcohol consumption (Gill, 2002), and first year undergraduates are shown to consume more than non-university attending peers (Kypri, Cronin, & Wright, 2005) and students in subsequent years (Bewick et al., 2008). Alcohol use and predictors of drinking behaviour among the student population have been extensively examined (e.g. Courtney & Polich, 2009; Gill, 2002; Wicki, Kuntsche, & Gmel, 2010). In addition to cognitive antecedents such as alcohol-related outcome expectancies, demographic factors have been shown to predict alcohol consumption. For example, alcohol consumption has been shown to be higher in students that are younger (e.g. Paschall & Saltz, 2007), single (e.g. Sun, Maurer, & Ho, 2003), white (e.g. Heather et al., 2011), male (e.g. Neighbors, Lee, Lewis, Fossos, & Larimer, 2007), and live on campus (Wechsler, Lee, Nelson, & Kuo, 2002).

This study aimed to determine the efficacy of the outcome-expectancy model (Tiffany, 1999) in explaining the relationship between expectancies, craving, and alcohol consumption, and examined the effect of a positive and negative imagery script-guided expectancy manipulation on expectancies, craving, and consumption. It was predicted that higher positive expectancies would be associated with higher levels of craving and alcohol consumption as suggested by the outcome-expectancy model (Tiffany, 1999), and higher negative expectancies would be associated with lower levels of craving and alcohol consumption. Participants allocated to the positive script condition were expected to show higher, whereas those in the negative script condition were predicted to show lower, positive expectancies, positive mood, and craving, compared to participants in the neutral condition. Participants in the negative condition were also expected to show higher negative expectancies than participants in the neutral condition. Participants in the positive condition were predicted to consume a higher volume of alcohol than participants in the neutral condition during a taste-test following the manipulation, whereas participants in the negative condition were predicted to consume a lower volume. Craving ratings following the consumption of alcohol during the taste-test were expected to differentiate between manipulation conditions.

2.3. Method

2.3.1. Participants

Sixty first year undergraduate students (50% female), aged 18-26 years old (M = 19.60 years, SD = 1.41 years), were recruited to participate in two alcohol-related studies during a single session from a UK campus university using advertisements via email and an online research participation scheme. A taste-test was posed as a second study to counteract demand effects following the first study. Eligibility was determined

using an online screening questionnaire and medical questionnaire. Eligible participants exceeded weekly-recommended alcohol consumption guidelines (≥14 units per week for females, ≥21 units per week for males) and indicated that they liked the taste of lemonade and cider (≤3 on a scale of 1-5; 1 - like, 5 - dislike). Due to the nature of the study (i.e., alcohol-related), participants were excluded if they were not in good health, taking any medication (excluding the contraceptive pill), had a history of alcohol abuse, were pregnant, or breastfeeding. Participants were also excluded if they were not a native English speaker to ensure full comprehension of the study materials. An equal number of males and females were randomly allocated to one of three conditions; positive script (n = 20), negative script (n = 20), or neutral script (n = 20). Participants were given £20 or 18 research credits as compensation for their time.

2.3.2. Questionnaires

Online screening questionnaire. To determine eligibility for the study, first year undergraduate students were asked to complete an online screening questionnaire (Appendix A) that included alcohol consumption and demographic measures. Level of risk associated with alcohol consumption was measured using the 10-item Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monterio, 2001). Each item yields a score of 0-4, with a possible total score of 40, which reflects "level of risk related to alcohol" (Babor et al., 2001, p.19). Items evaluate alcohol consumption, negative consequences, and behaviours indicative of possible dependence on 3- and 5-point response scales. Scores of 8-15 are indicative of hazardous drinking, 16-19 indicates harmful drinking, and 20+ indicate possible dependence warranting further diagnostic testing.

Alcohol use was measured with the Alcohol Use Questionnaire (AUQ; Mehrabian & Russell, 1978). A composite AUQ score (see Mehrabian & Russell, 1978)

was calculated from items measuring the number of alcoholic beverages consumed in a typical week, speed of drinking, number of times intoxicated in the past six months, and percentage of times drunk when drinking.

The number of units consumed in a typical week was calculated from responses to the AUQ by estimating a glass of wine to be 2.1 units, a pint of beer at 2.3 units, a pint of cider at 2.8 units, a single measure of spirit at 1 unit, and a bottle of alcopop at 1.4 units. Participants were eligible to take part if they exceeded weekly-recommended guidelines (≥ 14 units per week for females, ≥ 21 units per week for males).

Ten items, designed for the purpose of this study, measured the degree to which participants enjoyed the taste of five types of alcoholic beverage (wine, beer, cider, spirits, and alcopops), and soft drink (water, fruit juice, fruit cordial/squash, cola, and lemonade), on 5-point response items (1 - like, 5 - dislike). Participants that indicated that they disliked lemonade or cider (> 3) were excluded from the study.

Demographic measures including sex, age, year of study, accommodation type, sexuality, relationship status, and ethnicity were also included.

General health. The Nuffield's Medical History Questionnaire (Appendix B) assessed participants' health status, including whether they had suffered from various illnesses, current medication usage, and general health status. Responses were assessed for any indication of poor health, use of medication (other than the contraceptive pill), or history of alcohol abuse.

Alcohol-related outcome expectancies. Thirty-eight 7-point response items from the Comprehensive Effects of Alcohol questionnaire (CEOA; Fromme et al., 1993; Appendix C) were used to measure alcohol-related outcome expectancies. The items were randomised and presented on a computer screen to examine how participants would feel under the influence of alcohol (e.g., "I would feel courageous"; 1 - strongly

disagree, 7 - strongly agree). Mean scores were used to quantify four positive (sociability, tension reduction, liquid courage, and sexuality) and three negative expectancies (cognitive and behavioural impairments, risk and aggression, and self-perception). Two composite factors (positive expectancies and negative expectancies) were also calculated by calculating the mean score for all positive and all negative expectancy item responses.

According to Kline's (1999) recommended Cronbach's alpha (α) cut-off score of $\geq .7$, the majority of the scales were shown to have acceptable or good internal consistency at time 1 and 2 of completion. The liquid courage (time 1 - $\alpha = .75$; time 2 - $\alpha = .83$), cognitive and behavioural impairments (time 1 - $\alpha = .76$; time 2 - $\alpha = .83$), risk and aggression (time 1 - $\alpha = .83$; time 2 - $\alpha = .82$), sociability (time 1 - $\alpha = .81$; time 2 - $\alpha = .84$), sexuality (time 1 - $\alpha = .78$; time 2 - $\alpha = .84$), composite positive (time 1 - $\alpha = .89$; time 2 - $\alpha = .91$), and composite negative expectancy scales (time 1 - $\alpha = .85$; time 2 - $\alpha = .83$) were all reliable measures. One item was removed from the self-perception scale to improve reliability from $\alpha = .55$ to $\alpha = .66$ at time 1, without considerably altering reliability at time 2 ($\alpha = .74$ to $\alpha = .73$). The tension reduction expectancy scale had slightly questionable internal consistency with a Cronbach's alpha of .66 at time 1, and .65 at time 2. However, since these alphas did not deviate drastically from .7, the scales were retained in subsequent analysis.

Craving. Fourteen statements from the Desires for Alcohol Questionnaire (DAQ; Love, James, & Willner, 1998; Appendix D) were randomised and presented on a computer screen. Participants were asked to respond to the statements, taking into account how they felt about drinking alcohol at that moment, on 7-point response items (e.g., "I want a drink so much I can almost taste it"; 1 - strongly disagree, 7 - strongly agree). Mean scores were used to quantify four scales of cravings and urges for alcohol

(strong desires and intentions to drink alcohol, mild desires, control over drinking, and negative reinforcement). The items for the control over drinking scale were reverse-coded to provide a scale that reflects loss of control.

Three of the four scales derived from the questionnaire were shown to have consistent reliability across the five time points of completion. Specifically, strong desires and intentions to drink alcohol (time 1 - α = .80; time 2 - α = .83; time 3 - α = .80; time 4 - α = .86; time 5 - α = .81), mild desires (time 1 - α = .89; time 2 - α = .92; time 3 - α = .93; time 4 - α = .94; time 5 - α = .92), and negative reinforcement ratings (time 1 - α = .82; time 2 - α = .85; time 3 - α = .87; time 4 - α = .87; time 5 - α = .89) were all shown to have good reliability. Loss of control over drinking was shown to have questionable internal consistency at time 1 (α = .48), 2 (α = .29) and 3 (α = .49), but good reliability at time 4 (α = .78) and 5 (α = .89). The loss of control scale is calculated from two reverse-scored items; “if I started drinking now I would be able to stop” and “I could easily limit how much I would drink if I drank now”. Consequently, these items were treated as separate scales in the subsequent analysis; loss of control over stopping alcohol consumption and loss of control over limiting alcohol consumption.

Mood. Seventy-two items from the Profile of Mood States questionnaire (POMS; McNair, Lorr, & Droppleman, 1971; Appendix E) were randomised and presented on a computer screen. Participants were asked to indicate how well each adjective represented their current mood state on 5-point response items (e.g., “friendly”; 1 - not at all, 5 - extremely). Two composite scores (De Wit & Doty, 1994) were calculated from the mean scores of six of the eight original factors; arousal ((anxiety + vigor) – (fatigue + confusion)) and positive mood (elation – depression).

Imagery script ratings. Three 7-point response items, designed for the purpose of this study (Appendix F), evaluated the degree to which participants could imagine themselves in their given script (1 - not at all, 7 - extremely well), the degree to which they could relate to their given script (1 - not at all, 7 - extremely well), and the extent to which the script was considered as negative or positive (1 - extremely negative, 7 - extremely positive).

2.3.4. Alcohol-Related Outcome Expectancy Manipulation

Imagery scripts. Gender-specific alcohol-related and neutral imagery scripts were designed for the purpose of the study. The positive alcohol-related imagery script (Appendix G) was designed to bolster positive alcohol-related expectancies, and the negative alcohol-related imagery script (Appendix H) was designed to bolster negative alcohol-related expectancies and contradict positive alcohol-related expectancies. Both scripts lead the participant to imagine themselves on a student night out with their new flat mates during the first few weeks of term.

During the positive script the participant is primed to expect to feel less stressed about workload after drinking alcohol (e.g., “having a few drinks tonight will definitely help you to relax after such a stressful day”), more sociable (e.g., “you feel tipsy; conversation is flowing easily and everyone is laughing and having a good time”), courageous (e.g., “The tequila has taken effect and you dance confidently with no inhibitions”), and sexual (e.g., “The alcohol has given you more confidence, makes you feel turned on, and eases your ability to strike up a conversation”).

During the negative script the participant is primed to expect to experience cognitive and behavioural impairments (e.g., “you feel tipsy; you’re dizzy and find that you’re more clumsy than usual”), increased aggression (e.g., “Unable to control your anger you push him aggressively in the chest and shout at him”), and negative self-

perception (e.g., “You exchange banter with one of your flat mates but take offence and feel self-conscious and stupid”). They are also primed to expect increased tension (e.g., “you’re tense and regret coming out at all”), an inability to socially interact (e.g., “The alcohol has made it difficult to follow conversation and you’re slurring your words”), unattractive behaviour (e.g., “you realise how unattractive your behaviour is”), and loss of confidence (e.g., “Your cheeks flush red with embarrassment and you lose your confidence”).

The neutral script (Appendix I) was matched to the positive and negative script in terms of length and complexity, and leads the participant to imagine they are going to a café with their new flat mates during the first few weeks of term.

2.3.4. Procedure

Following ethical approval (granted by the School of Life Sciences Research Governance Committee at the University of Sussex; Appendix J), eligible participants from the screening questionnaire were invited to participate in two alcohol-related studies, during a single laboratory session, lasting up to 4.5hrs. The taste-test was posed as a second study to reduce demand effects. Upon arrival, participants were given an information sheet and consent form to sign and seated in an individual cubicle with a computer for the duration of the two studies.

Results presented in this paper were part of a larger study that also measured attentional bias with a Visual Probe Task (VPT; see Townshend & Duka, 2001) and implicit positive and negative associations with alcohol using two modified Implicit Association Tasks (IATs; see Greenwald, McGhee, & Schwartz, 1998). No significant differences or effects were found relating to these tasks. Therefore, the results are not reported here. However, It should be noted that these tasks were time-consuming and included the use of pictorial and written alcohol-related stimuli. As such, these tasks

may have produced fatigue or priming effects on other outcomes. Since all participants were exposed to the same tasks and stimuli (in a counterbalanced and randomised order), it is expected that these would be global effects experienced by all participants.

Participants were first asked to complete the DAQ and provide a breath alcohol content (BrAC) sample using a hand-held breathalyser (Lion Alcolmeter® SD-400, Lion Laboratories Ltd, Barry, UK), to ensure a nil reading (0.0mg/l). They were then asked to complete the POMS, medical questionnaire, and CEOA. An equal number of males and females from each condition then completed the VPT, followed by two IATs, or vice versa. Following the cognitive tasks, participants completed the DAQ for a second time, and listened to either the positive, negative, or neutral imagery script. Participants were asked to imagine that they were in the given situation whilst listening. They then completed the imagery script ratings, DAQ for a third time, and POMS for a second time. The researcher gave the participant 5mins to recall and write down as much of the script they could remember before completing the CEOA for a second time and the VPT and IAT tasks in the same order as previously given. Participants completed the DAQ for a fourth time, POMS for a third time, and given a further 5mins to recall and write down as much of the imagery script that they could remember. They were then told that the first study had finished and that the second study was about to start. To try and counteract practice effects in ‘study one’, the stimuli and questions in all tasks and questionnaires were randomised. The order of VPT and IAT completion were also counterbalanced.

Participants were told that they would be brought six drinks, which would alternate between alcoholic and non-alcoholic beverages. Participants were asked to rate each drink on pleasantness (unpleasant to pleasant) and strength of taste (tasteless to strong-tasting) using two 10cm visual analogue scales created for the purpose of the

study (Appendix K). Three 165ml glasses of lemonade and three 165ml glasses of cider (Woodpecker® 3.5% ABV) were individually presented to the participants in identical glasses with the taste rating form. The researcher left the participant with each drink and rating form for 3mins. Five males and five females in each condition were given cider as their first drink and the remaining participants were given lemonade. Following the removal of the sixth drink participants were asked to complete the DAQ for a fifth time. Participants were debriefed and permitted to leave the laboratory when their BrAC fell under 0.17mg/l, which is equivalent to less than half the UK legal driving limit (0.35mg/l).

2.3.5. Statistical Analysis

Prior to the statistical analyses, the data was examined to ensure parametric assumptions were met. In instances where assumptions were violated, transformations were utilised. If outliers were detected and transformations did not correct violations, the value of the outlier was replaced with the next highest/lowest score plus one or the mean value plus or minus two standard deviations (Field, 2005). Due to multiple comparisons used in the following statistical analyses, a *p*-value of .01 was used to indicate significant results. Where appropriate, effect sizes are presented and discussed.

Baseline equivalence. To examine baseline equivalence between groups, chi-square or one-way between subjects ANOVA with condition as the between-subjects factor (positive, negative, or neutral) were performed on demographic and baseline data.

Correlation analysis. To investigate the hypothesised relationships between expectancies, craving, and alcohol consumption, bivariate correlation analyses were performed. Specifically, the relationships between alcohol consumption as measured using the AUQ and AUDIT, outcome expectancies, and craving at baseline were

examined, and alcohol consumption during the taste-test, outcome expectancies, and craving measured prior to the taste-test were examined.

Manipulation effects. To determine the effects of imagery script condition on expectancies, craving, and mood following the manipulation, alcohol consumption during the taste-test, and craving ratings following the taste-test, one-way analysis of covariance (ANCOVA) were used. Group differences in post-manipulation and post-taste-test ratings were examined after controlling for the corresponding pre-manipulation and pre-taste-test ratings, respectively (e.g., Van Breukelen, 2006).

Bivariate correlation analyses were performed prior to each ANCOVA to determine whether the inclusion of theoretically relevant covariates (i.e., baseline alcohol consumption variables and the ability to imagine/relate to the given script) would improve the accuracy of the model. Covariates were included if they were significantly associated with the dependent variable and not significantly associated with other covariates. Priority for covariate inclusion was given to the pre-manipulation measure and then on the magnitude of effect (Pearson's *r*) on the dependent variable. Planned contrasts were used to compare each of the experimental conditions (negative and positive) to the control condition (neutral).

2.4. Results

2.4.1. Baseline Equivalence

Demographic information, screening questionnaire responses, and baseline data are presented in Table 1. Levene's test indicated that the total AUQ scores violated the assumption of homogeneity of variance ($F(2,57) = 3.54$, $p = .04$). Log transformed total AUQ scores were shown to meet the assumption ($F(2,57) = 2,43$, $p = .10$) and used in

Table 1. Baseline characteristics and scores for participants in each condition. Mean with standard deviation in parenthesis, or frequency with percentage in parenthesis given. ANOVA/Chi-Square results provided for the main effect of condition.

	Condition			
	Positive (n = 20)	Negative (n = 20)	Neutral (n = 20)	ANOVA / Chi-Square
Age	19.40 (0.75)	19.95 (2.19)	19.40 (0.75)	$F(2,57) = 1.02$, $p = .37$
Relationship Status (n = 59)				
Single	11 (55%)	15 (75%)	10 (50%)	
In a Relationship	9 (45%)	5 (25%)	9 (45%)	$X^2(2, N = 59) = 2.51$, $p = .29$
Accommodation Type (n = 59)				
On Campus	17 (85%)	17 (85%)	19 (98%)	
Privately Rented	3 (15%)	3 (15%)	0 (0%)	$X^2(2, N = 59) = 3.17$, $p = .21$
Drink Preference Ratings				
Lemonade Preference	1.50 (0.69)	1.45 (0.69)	1.45 (0.60)	$F(2,57) = 0.04$, $p = .96$
Cider Preference	1.65 (0.75)	1.80 (0.70)	1.90 (0.91)	$F(2,57) = 0.51$, $p = .61$
Alcohol Consumption				
AUDIT Total	15.45 (3.52)	16.85 (6.72)	17.15 (4.00)	$F(2,57) = 0.67$, $p = .52$
AUQ Total [a]	67.46 (26.55)	80.68 (42.52)	95.05 (36.12)	$F(2,57) = 3.09$, $p = .05$
Outcome Expectancies (CEOA)				
Sociability	5.87 (0.65)	5.65 (1.01)	5.62 (0.71)	$F(2,57) = 0.57$, $p = .57$
Tension Reduction	4.25 (0.81)	4.27 (1.01)	4.37 (0.95)	$F(2,57) = 0.09$, $p = .91$
Liquid Courage	4.45 (0.95)	4.24 (1.33)	4.49 (0.71)	$F(2,57) = 0.34$, $p = .71$
Sexuality	4.04 (0.97)	4.14 (1.48)	3.98 (1.19)	$F(2,57) = 0.09$, $p = .92$
Impairments	4.68 (0.74)	4.76 (0.85)	4.60 (0.81)	$F(2,57) = 0.20$, $p = .82$
Risk & Aggression	3.94 (1.15)	4.24 (1.25)	4.15 (1.09)	$F(2,57) = 0.35$, $p = .71$
Self-Perception	2.54 (0.78)	2.86 (1.15)	2.51 (0.71)	$F(2,57) = 0.61$, $p = .55$

Positive Expectancies	4.91 (0.63)	4.79 (0.97)	4.82 (0.66)	$F(2,57) = 0.12$, $p = .88$
Negative Expectancies	4.00 (0.70)	4.19 (0.71)	4.01 (0.69)	$F(2,57) = 0.50$, $p = .61$
Craving (DAQ)				
Strong Desires	2.29 (0.90)	2.30 (0.83)	2.62 (0.96)	$F(2,57) = 0.85$, $p = .43$
Mild Desires	3.85 (1.66)	3.25 (1.39)	4.10 (1.57)	$F(2,57) = 0.57$, $p = .57$
Loss of Control: Stopping	1.20 (1.52)	1.70 (1.38)	2.20 (1.54)	$F(2,57) = 3.29$, $p = .04$
Loss of Control: Limiting	1.90 (1.45)	1.55 (1.26)	2.25 (1.59)	$F(2,57) = 1.42$, $p = .25$
Negative Reinforcement	2.71 (1.37)	2.61 (1.20)	2.79 (1.16)	$F(2,57) = 0.10$, $p = .91$
Mood (POMS)				
Arousal	0.32 (1.00)	0.97 (1.02)	0.82 (1.07)	$F(2,57) = 2.16$, $p = .12$
Positive Mood	1.17 (1.01)	1.88 (0.91)	1.61 (0.84)	$F(2,57) = 3.04$, $p = .06$

[a] Log transformation used

the subsequent analysis. Results indicated that none of the group differences reached significance at the .01 level. However, the difference in AUQ scores, loss of control over stopping alcohol consumption, and positive mood should be noted.

2.4.2. Correlation Analysis

Table 2 shows the bivariate correlations between expectancies, craving, and alcohol consumption. Cohen's (1988; 1992) criteria, where $r = .10$ is a small effect, $r = .30$ is a medium effect, and $r = .50$ is a large effect, have been used to interpret effect sizes. At baseline, higher composite positive expectancy ratings were associated with higher strong desires and intentions, mild desires, and negative reinforcement craving ratings. These correlations were all shown to have medium effect sizes. Each of the four positive expectancy scales was positively correlated with at least one of these craving scales. The relationship between liquid courage expectancy ratings and negative reinforcement ratings was shown to have the largest effect size, with the belief that alcohol increases courage accounting for 24% of the variance in believing that drinking would alleviate negative affect. Negative expectancies were not significantly associated with craving.

Only one of the five craving scales was shown to be significantly associated with one of the alcohol consumption measures. Higher perceived loss of control over stopping alcohol consumption was associated with higher levels of risk related to drinking (AUDIT), but not general alcohol use (AUQ) or cider consumption during the taste-test. AUDIT scores were able to account for 12% of the variance in believing that alcohol consumption could not be stopped once it had started. No other craving ratings were significantly associated with alcohol consumption. Of note, AUDIT scores and AUQ scores were significantly correlated, and AUQ scores and cider consumption were significantly correlated, but AUDIT scores were not associated with cider consumption.

Table 2. Bivariate correlations (r) between outcome expectancies, craving, and alcohol consumption measures (N = 60).

Variable		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	AUDIT Total	-															
2	AUQ Total	**.46****	-														
3	Sociability	.25	.15	-													
4	Tension Reduction	.06	.06	.18	-												
5	Liquid Courage	**.33***	**.33***	**.67****	**.38***	-											
6	Sexuality	**.36***	**.34***	**.62****	.18	**.58****	-										
7	Impairments	.25	.12	.17	-.00	.10	.08	-									
8	Risk & Aggression	**.42***	**.47****	**.65****	.12	**.64****	**.61****	**.37***	-								
9	Self-Perception	.18	.01	.06	**-.35***	-.09	.17	**.55****	.12	-							
10	Positive Expectancies	**.34***	.29	**.88****	**.44****	**.87****	**.81****	.13	**.71****	-.01	-						
11	Negative Expectancies	**.40***	.30	**.39***	-.03	**.35***	**.40***	**.87****	**.72****	**.60****	**.40***	-					
12	Strong Desires	.05	.12	.22	.28	.30	**.35***	-.27	.07	-.07	**.35***	-.12	-				
13	Mild Desires	.09	.12	.23	**.34***	**.33***	.32	-.22	.07	-.06	**.37***	-.10	**.83****	-			
14	Loss of Control: Stopping	**.35***	.07	.00	.20	.17	.14	-.13	.04	-.15	.13	-.10	.05	.11	-		
15	Loss of Control: Limiting	.11	.18	-.06	.02	.14	.02	-.14	-.09	-.17	.03	-.18	.02	.11	.31	-	
16	Negative Reinforcement	.13	-.05	**.37***	.17	**.49****	**.40***	-.09	.17	.08	**.48****	.06	**.66****	**.63****	.17	.14	-
17	Cider Consumed (ml)	.25	**.45****	**.32***	.17	**.41***	.20	.08	.30	-.01	**.37***	.20	.30	.25	.15	.13	.19

Notes. **Bold** indicates significant correlation; *$p < .01$; **$p < .001$.

Composite positive and negative expectancies were shown to have medium-sized significant positive correlations with level of risk associated with alcohol consumption (AUDIT). Higher composite positive expectancy ratings prior to the taste-test were also significantly associated with higher volumes of cider consumed during the taste-test. The relationship between alcohol use (AUQ) and composite positive expectancies ($r(58) = .29$, $p = .02$), and between alcohol use (AUQ) and composite negative expectancies ($r(58) = .30$, $p = .02$), failed to reach significance. The sexuality, liquid courage, and risk and aggression expectancy rating scales had significant positive relationships with level of risk associated with alcohol consumption (AUDIT) and general alcohol use (AUQ). Liquid courage expectancies were also significantly associated with the volume of cider consumed during the taste test. Of the expectancy scales, risk and aggression was shown to have the largest relationship with alcohol consumption measures. Level of risk associated with alcohol and general alcohol use were able to explain 18% and 22% of the variance in risk and aggression expectancies, respectively. Of note, the composite positive and composite negative expectancy ratings were shown to have a large significant positive association, indicating that those with high positive alcohol-related outcome expectancies were also shown to have high negative expectancies. The relationship between risk and aggression expectancy ratings and the composite positive expectancy ratings were shown to be particularly large, with risk and aggression expectancies explaining 50% of the variance in positive expectancies.

2.4.3. Manipulation Effects

Expectancies, mood, and craving following the manipulation. Unadjusted pre- and post-manipulation mean alcohol-related expectancy, mood, and craving ratings, and the main effect of condition (ANCOVA) are presented in Table 3. Cohen's (1988)

Table 3. Unadjusted mean ratings before and after positive, negative, or neutral imagery script manipulation with SEM in parenthesis. ANCOVA results provided for the main effect of condition.

	Condition						
	Positive (n = 20)		Negative (n = 20)		Neutral (n = 20)		
	Before	After	Before	After	Before	After	ANCOVA
Alcohol-Related Expectancies							
Sociability [a]	5.56 (0.17)	6.04 (0.14)	5.42 (0.23)	5.76 (0.20)	5.40 (0.16)	5.90 (0.12)	$F(2,56) = 0.82$, $p = .44$, $\eta p^2 = .03$
Tension Reduction [a]	4.25 (0.18)	4.55 (0.19)	4.27 (0.23)	4.10 (0.22)	4.37 (0.21)	4.63 (0.23)	$F(2,56) = 3.02$, $p = .06$, $\eta p^2 = .10$
Liquid Courage [a]	4.45 (0.21)	4.72 (0.23)	4.24 (0.30)	4.43 (0.34)	4.49 (0.16)	4.53 (0.21)	$F(2,56) = 0.46$, $p = .64$, $\eta p^2 = .02$
Sexuality [a]	4.04 (0.22)	4.45 (0.25)	4.14 (0.33)	4.25 (0.35)	3.97 (0.27)	4.21 (0.26)	$F(2,56) = 0.68$, $p = .51$, $\eta p^2 = .02$
Impairments [a, b]	4.68 (0.17)	4.64 (0.20)	4.76 (0.19)	4.69 (0.25)	4.60 (0.18)	4.66 (0.18)	$F(2,55) = 0.28$, $p = .76$, $\eta p^2 = .01$
Risk & Aggression [a]	3.94 (0.26)	3.98 (0.23)	4.24 (0.28)	4.41 (0.30)	4.15 (0.24)	4.06 (0.23)	$F(2,56) = 0.87$, $p = .42$, $\eta p^2 = .03$
Self-Perception [a]	3.70 (0.19)	2.38 (0.18)	3.58 (0.29)	3.17 (0.33)	3.13 (0.21)	2.63 (0.19)	$F(2,56) = 3.86$, $p = .03$, $\eta p^2 = .12$
Positive Expectancies [a]	4.91 (0.14)	5.17 (0.16)	4.79 (0.22)	4.87 (0.22)	4.82 (0.15)	5.03 (0.15)	$F(2,56) = 0.75$, $p = .48$, $\eta p^2 = .03$
Negative Expectancies [a]	4.00 (0.16)	3.92 (0.15)	4.19 (0.16)	4.24 (0.19)	4.01 (0.15)	4.02 (0.15)	$F(2,56) = 0.64$, $p = .53$, $\eta p^2 = .02$
Mood							
Arousal [a]	0.32 (0.22)	0.05 (0.30)	0.97 (0.23)	0.72 (.27)	0.82 (0.24)	0.10 (0.22)	$F(2,56) = 1.28$, $p = .29$, $\eta p^2 = .04$
Positive Mood [a]	1.17 (0.22)	1.37 (0.20)	1.88 (0.20)	1.88 (.19)	1.61 (0.19)	1.72 (0.16)	$F(2,56) = 0.07$, $p = .93$, $\eta p^2 = .002$
Craving							
Strong Desires [a]	2.81 (0.19)	2.86 (0.20)	2.88 (0.23)	2.40 (0.17)	3.08 (0.28)	2.74 (0.26)	$F(2,56) = 4.17$, $p = .02$, $\eta p^2 = .13$
Mild Desires [a]	4.43 (0.38)	4.43 (0.40)	4.10 (0.38)	**3.28 (0.36)**	4.60 (0.39)	**4.40 (0.36)**	$\mathbf{F(2,56) = 6.66, p = .003, \eta p^2 = .19}$
Loss of Control: Stopping [a]	2.15 (0.41)	2.20 (0.40)	1.95 (0.32)	1.60 (0.20)	3.50 (0.48)	2.50 (0.37)	$F(2,56) = 0.81$, $p = .45$, $\eta p^2 = .03$
Loss of Control: Limiting [a]	2.10 (0.35)	1.80 (0.27)	1.95 (0.26)	1.90 (0.32)	2.45 (0.34)	2.40 (0.36)	$F(2,56) = 0.67$, $p = .51$, $\eta p^2 = .02$
Negative Reinforcement [a]	2.76 (0.33)	2.83 (0.33)	2.58 (0.23)	2.11 (0.19)	2.93 (0.32)	2.99 (0.33)	$F(2,56) = 4.03$, $p = .02$, $\eta p^2 = .13$

Notes. **Bold** indicates significant effect of condition; [a] Pre-manipulation score included as a covariate; [b] AUDIT score included as a covariate.

criteria, where a partial eta-squared (ηp^2) above .01 can be interpreted as a small effect, above .06 as a medium effect, and above .14 as a large effect, have been used to interpret the size of effect.

The effect of condition on the post-manipulation alcohol-related outcome expectancy, and mood ratings failed to reach significance at the .01 level. However, condition was shown to have medium-sized effects on tension reduction and self-perception expectancy ratings after controlling for pre-manipulation ratings, explaining 10% and 12% of the variance in these measures, respectively. Participants in the negative condition had lower tension reduction and higher self-perception ratings than participants in the positive and neutral conditions following the manipulation.

There was a significant effect of group on post-manipulation mild desires ratings after controlling for pre-manipulation ratings. According to Cohen's (1988) criteria, this constitutes a large effect, with condition explaining 19% of the variance in mild desire ratings following the imagery script manipulation. Planned contrasts showed that participants in the negative condition had significantly lower mild desires than participants in the neutral condition (p = .004, 95% CI [-1.20, -.19]; one-tailed).

The effect of condition on strong desires, negative reinforcement, and the two loss of control ratings failed to reach significance at the .01 level. However, condition was shown to have medium-sized effects on strong desires and negative reinforcement ratings after controlling for pre-manipulation ratings, explaining 13% of the variance in both of these measures. Participants in the negative condition had lower strong desires and negative reinforcement ratings than participants in the positive and neutral conditions following the manipulation.

Cider consumption during the taste-test. Participants in the negative condition consumed the least amount of cider during the taste-test (M = 247.00ml, SEM =

32.83ml), followed by participants in the positive condition (M = 252.35ml, SEM = 26.60ml) and participants in the neutral condition (M = 269.25ml, SEM = 29.69ml). The effect of condition on the amount of cider consumed during the taste-test, after controlling for AUQ scores and cider pleasantness ratings, failed to reach significance ($F(2,55) = 1.51$, $p = .23$, $\eta p^2 = .05$).

Craving following the taste-test. Unadjusted pre- and post-taste-test mean craving ratings, and the main effect of condition (ANCOVA) are presented in Table 4. There was a large significant effect of group on post-manipulation perceived loss of control over limiting alcohol consumption after controlling for pre-manipulation ratings and AUDIT scores. Condition explained 16% of the variance in perceived loss of control over limiting drinking following the taste-test. Planned contrasts showed that participants in the negative condition had higher perceived loss of control than participants in the neutral condition, but this failed to reach significance at the .01 level (p = .02, 95% CI [0.13, 1.33]; two-tailed).

The effect of condition on the remaining craving ratings failed to reach significance. However, condition was shown to have medium-sized effect on perceived loss of control over stopping alcohol consumption after controlling for pre-manipulation ratings, explaining 6% of the variance in this measure following the taste-test.

2.5. Discussion

This study examined the relationship between expectancies, craving, and alcohol consumption, and the effects of an imagery driven expectancy manipulation among heavy drinking undergraduate students. Correlation analyses provided support for the relationship between positive expectancies and craving, and expectancies and alcohol consumption. Effects of the expectancy manipulation were observed for craving and loss of control over limiting alcohol consumption following the taste-test. Implications

Table 4. Unadjusted mean ratings before, and after taste-test for participants in the positive, negative, and neutral condition with SEM in parenthesis. ANCOVA results also provided for the effect of condition.

	Condition						
	Positive		Negative		Neutral		ANCOVA
	Before	After	Before	After	Before	After	
Craving							
Mild Desires [a, b]	4.37 (0.39)	4.52 (0.35)	3.88 (0.39)	4.37 (0.34)	5.03 (0.37)	4.57 (0.34)	$F(2,56) = 0.99$, $p = .38$, $\eta p^2 = .03$
Strong Desires [a]	2.87 (0.25)	2.90 (0.24)	2.54 (0.22)	2.73 (0.21)	3.23 (0.29)	2.79 (0.20)	$F(2,55) = 1.02$, $p = .37$, $\eta p^2 = .04$
Loss of Control: Stopping [a]	2.25 (0.43)	1.90 (0.34)	1.55 (0.15)	2.30 (0.32)	2.00 (0.19)	2.10 (0.29)	$F(2,56) = 1.76$, $p = .18$, $\eta p^2 = .06$
Loss of Control: Limiting [a, b]	1.90 (0.28)	1.55 (0.17)	1.60 (0.17)	**2.40 (0.34)**	1.95 (0.20)	**1.85 (0.18)**	$\mathbf{F(2,55) = 5.03, p = .01, \eta p^2 = .16}$
Negative Reinforcement [a]	2.66 (0.29)	2.64 (0.32)	2.18 (0.23)	2.46 (0.28)	2.95 (0.33)	2.81 (0.32)	$F(2,55) = 0.89$, $p = .42$, $\eta p^2 = .03$

Notes. **Bold** indicates significant effect of condition; [a] Pre-taste-test score included as a covariate; [b] AUDIT score included as a covariate

of these findings for the craving literature and use of imagery driven expectancy manipulations as a potential intervention component are discussed.

As predicted, correlation analyses showed that holding positive expectations regarding the effects of alcohol is related to having stronger desires for alcohol and believing that the consumption of alcohol would eradicate negative affect (negative reinforcement). This finding supports the role of positive expectations of alcohol effects in craving as suggested by the outcome-expectancy model (Tiffany, 1999). More broadly, it supports the role of alcohol-related cognition in the craving literature.

Negative expectancies have been less extensively researched than positive expectancies (Adams & McNeil, 1991; Jones et al., 2001) and have been neglected in previous craving studies. The findings from the correlation analysis showed that negative expectancies were not significantly associated with craving. As such, these findings confirm that negative expectancies do not play a role in Tiffany's (1999) outcome-expectancy model of craving.

The lack of significant correlations shown between negative expectancies and craving in this study may be explained by differential roles of expectancies (McMahon, Jones, & O'Donnell, 1994). While positive expectancies are related to initiating consumption, negative expectancies are thought to be associated with the motivation to restrain drinking. As such, it would follow that positive expectancies are a better predictor of craving (as a desire to initiate drinking) than negative expectancies.

Alcohol use and level of risk associated with alcohol consumption were positively associated with positive and negative expectancies. Although it would be logical to assume that higher expectations regarding the negative effects of alcohol would lead to lower levels of drinking, the findings show the opposite relationship with the retrospective alcohol consumption measures. This finding has been observed

previously (Lee et al., 1999) and may reflect the relationship between consequences regularly experienced by heavier drinkers following their alcohol consumption. This may also explain why significant relationships were observed between negative expectancies and the retrospective measures of alcohol consumption, but not with alcohol consumed during the taste-test.

None of the craving scales were shown to significantly correlate with the volume of cider consumed during the taste-test, and only one craving scale was associated with one of the retrospective measures of alcohol consumption. Loss of control over stopping alcohol consumption was significantly correlated with AUDIT score, but not AUQ scores. As a result, this scale and may differentiate between general alcohol use and risk level associated with alcohol consumption. Loss of control is a diagnostic criterion of DSM-IV alcohol dependence (DSM-IV: American Psychiatric Association, 1994), and the loss of control factor of the DAQ has been shown to differentiate between social drinkers and alcoholic inpatients (Townshend & Duka, 2007).

As predicted, participants in the negative condition showed lower mild desires craving ratings than those in the neutral condition following the manipulation. No significant manipulation effects were observed for alcohol-related outcome expectancies or alcohol consumption. As such, the expectancy manipulation has shown promise in affecting craving, but not by influencing the expectancies held by participants. Furthermore, the impact on craving was not reflected in alcohol consumption. Consequently, the outcome-expectancy model described by Tiffany (1999) cannot explain the affect of the manipulation on craving ratings.

Alcohol-related expectancies, derived from social learning theory (Bandura, 1977), continue to develop through experiences with alcohol. Using single exposure to

an imagery script that contradicts an individual's engrained beliefs may be ineffective. However, effectiveness may increase with continued exposure as suggested by previous research examining persuasive messages and attitude change (Cacioppo & Petty, 1989; Johnson & Watkins, 1971). In contrast, craving represents a contextually specific state and may be more amenable to manipulation.

The higher perceived loss of control over limiting alcohol consumption shown by participants in the negative condition following the taste-test is concerning. Encouraging participants to imagine the negative effects of alcohol, including cognitive and behavioural impairments, may prime higher perceived loss of control following the consumption of alcohol and act as a self-fulfilling prophecy (Merton, 1948). Alternatively, these findings could be explained by restraint theory (Herman & Polivy, 1980). Following the negative expectancy manipulation, participants may experience voluntary resistance towards alcohol consumption. The consumption of alcohol during the taste-test could then have a disinhibitory effect, and as a result, influence feelings of self-control over drinking behaviour. Properties of restraint theory have been examined extensively in eating and dietary behaviour literature (e.g., Ruderman, 1986). In either case, replication of these results would indicate that manipulating negative expectancies, for example, in health promotion materials designed to promote safe drinking, might need to be augmented by control-boosting components to avoid undermining perceived control over drinking alcohol.

The lack of internal consistency observed for the loss of control scale in this sample has important implications. For this sample, perceived loss of control over limiting alcohol consumption was not necessarily related to perceived loss of control over stopping drinking. This indicates that students may believe that they are able to limit their drinking but not necessarily stop once they have begun drinking or vice

versa. Future use of this scale should ensure that internal consistency is observed or treat the items as separate constructs. This finding also suggested that alcohol-related interventions aiming to bolster self-control might benefit from teaching practical strategies to both moderate and cease consumption behaviour once it has begun.

Some limitations of this study need to be considered. First, although group differences failed to reach significance at the .01 level, total AUQ scores, positive mood ratings, and perceived loss of control over stopping alcohol consumption at baseline were shown to have fairly large between-group differences. Subsequent analyses of the manipulation effects used ANCOVA to account for baseline variables that correlated with each dependent variable in question. However, it is possible that this baseline difference may have suppressed manipulation effects. In future, stratified sampling may help to avoid such a limitation. Second, when interpreting the effects of the negative expectancy manipulation, it is not possible to differentiate between the effects of bolstering negative expectancies and contradicting positive expectancies. Future research may consider comparing a script that aims to bolster negative expectancies, with a script that aims to contradict positive expectancies. Third, participants completed questionnaires a number of times during the study. Consequently, findings may be subject to practice and fatigue effects. Dividing the assessment of this manipulation into multiple sessions may counteract this limitation. Finally, due to the small sample size, this study lacks statistical power. A power analysis indicated that the study had 54% power to detect a large effect with a .01 statistical significance criterion. The medium-sized effect sizes observed for the manipulation for tension reduction expectancies, self-perception expectancies, strong desires and intentions to drink alcohol ratings, and negative reinforcement ratings may have been substantiated with a larger sample size.

Despite these limitations, this study required minimal face-to-face contact with participants and could easily be translated into a computer-delivered intervention (CDI). CDIs have a number of advantages, including the ability to reach large audiences (such as drinking students attending a university), and have been shown to be a preferred method of intervention delivery among students (Kypri, Saunders, & Gallagher, 2003). Consequently, future research may benefit from investigating the use of novel manipulations (such as the manipulation presented here) within CDIs.

In conclusion, higher positive alcohol expectancies predict desires to drink and alcohol consumption. Bolstering negative expectancies and contradicting positive expectancies are shown to reduce immediate craving ratings, but may be associated with a disinhibitory effect following the consumption of alcohol. The use of a negative expectancy imagery script manipulation may help to reduce craving among heavy drinking undergraduate students. However, as shown in this study, this component may not lead to reduced drinking and has the potential to cause disinhibitory effects following subsequent consumption.

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Chapter 3

Increasing negative alcohol-related outcome expectancies: Evaluating the efficacy of an imagery-script manipulation

3.1. Abstract

Despite the established relationship between positive and negative alcohol-related outcome expectancies and alcohol consumption, negative expectancies have been relatively neglected in the research. This study examined the effects of a repeated script-driven imagery manipulation that aims to bolster negative outcome expectancies and contradict positive outcome expectancies on alcohol-related cognitions and alcohol consumption. Forty first-year undergraduate students were allocated to receive a negative expectancy imagery script (n = 20) or a neutral script matched in length and complexity (n = 20). Repeated exposure to the manipulation was achieved using repeated recall over a week. Although the negative script manipulation was associated with immediate reductions in craving ratings and changes in outcome expectancies in the expected direction following repeated exposure, the observed effects were small and failed to reach statistical significance. Moreover, the effects of the manipulation on alcohol consumption as measured using daily drinking diaries during and after the manipulation were inconsistent. These findings are discussed in terms of practical implications for alcohol intervention.

3.2. Introduction

Expectancy theory encompasses principles of social learning (Bandura, 1977). Through personal and/or observational experience, individuals form positive and negative beliefs regarding the effects of alcohol on their emotions and behaviour. These beliefs are suggested to have different functions in alcohol use. Positive expectations (e.g., “I will feel more relaxed”) are thought to motivate an individual to initiate drinking, while negative expectations (e.g., “I will have a hangover in the morning”) are thought to motivate an individual to restrain drinking (McMahon, Jones, & O'Donnell, 1994). As a result, bolstering positive expectancies should theoretically increase consumption, while bolstering negative expectancies should reduce drinking.

The relationship between outcome expectancies and alcohol use has been extensively examined using different study designs (see Jones, Corbin, & Fromme, 2001). Cross-sectional surveys have established non-causal associations between expectancies and consumption behaviour (Pabst, Kraus, Piontek, Mueller, & Demmel, 2013; Wiers, van Woerden, Smulders, & de Jong, 2002), and longitudinal research has shown that expectancies can predict future drinking (Carey, 1995; Christiansen, Smith, Roehling, & Goldman, 1989; Patrick, Wray-Lake, Finlay, & Maggs, 2010).

Although expectancies have been shown to be amenable to manipulation or change through the use of priming words (Friedman, McCarthy, Pedersen, & Hicks, 2009; Stein, Goldman, & Del Boca, 2000) and alcohol-expectancy challenge paradigms (Darkes & Goldman, 1993), the resulting change in alcohol consumption has been less consistent. For instance, alcohol-expectancy challenges aim to confront an individual’s expectations regarding the effects of drinking. Participants are provided with a placebo or alcoholic beverage and asked to identify the drinkers among their peers after engaging in a social (e.g., playing a game) or sexual scenario (e.g., rating

attractiveness). Highlighting the fact that individuals who have been identified as drinkers in the group had consumed a placebo prompts a discussion of expectancies. This paradigm has been associated with reductions in expectancies and alcohol consumption (Lau-Barraco, & Dunn, 2008; Wiers, van de Luitgaarden, van den Wildenberg, & Smulders, 2005), reductions in expectancies but not alcohol consumption (Musher-Eizenman, & Kulick, 2003), and larger reductions in female students than male students (Wiers & Kummeling, 2004). Of note, the majority of these paradigms focus on positive expectancies; negative expectancies have been relatively neglected.

Outcome expectancies are also proposed as having an influential role in the relationship between drug-related cues and craving. The outcome-expectancy model (as described by Tiffany, 1999) originates from Marlatt's cognitive-behavioural model of relapse prevention (see Larimer, Palmer, & Marlatt, 1999; Marlatt & Gordon, 1985) and suggests that exposure to drug-related cues (e.g., a pub/bar environment) may activate positive expectations regarding drug effects (e.g., "having a drink would help me to relax") and generate craving. This model has been supported in opiate craving (Powell, Bradley, & Gray, 1992) and among hazardous drinkers (i.e., individuals who score ≥ 8 on the Alcohol Use Disorder Identification Test; AUDIT; Palfai, Davidson, & Swift, 1999). Again, positive expectancies are the primary focus and negative expectancies are overlooked.

Imagery scripts (i.e., narrative passages of text) have been used to increase craving in cigarette smokers (Tiffany & Drobes, 1990; Erblich, Montgomery, & Bovbjerg, 2009), alcohol-dependent men (Weinstein, Lingford-Hughes, Martinez-Raga, & Marshall, 1998), cocaine-dependent women (Kilts, Gross, Ely, & Drexler, 2004), and marijuana smokers (Singleton, Trotman, Zavahir, Taylor, & Heishman, 2002). These

scripts can be designed to manipulate cognitions such as craving and affective state (e.g., “You’re sitting in a reception, nervously waiting for an appointment. You’re dreading this meeting and things aren’t being helped by the fact that you’ve been trying not to smoke cigarettes over the past couple of days,” Tiffany & Drobes, 1990, p.533).

Although negative expectancies have been less extensively researched than positive expectancies (Adams & McNeil, 1991; Jones et al., 2001), they are shown to predict abstinence following treatment (Jones & McMahon, 1994) and lower alcohol consumption in social drinkers (Lee, Greely, & Oei, 1999; Nicolai, Moshagen, & Demmel, 2012). Moreover, an imagery script manipulation that aims to bolster negative expectancies and contradict positive expectancies has been associated with immediate reductions in craving for alcohol (Atwell, Duka, & Abraham, 2014). This study aims to replicate these findings and address some of the limitations by using repeated exposure to an imagery script manipulation as an alternative to single exposure, targeting individuals with at-risk expectancies (i.e., those with high positive expectancies and low negative expectancies), and measuring alcohol consumption with a drinking diary as an alternative to a laboratory setting.

3.2.1. Repeated Exposure to a Manipulation

Moderate levels of repetition (i.e., hearing a communication three times vs. once or five times) has been shown to increase the effect of persuasive messages on attitude change (Cacioppo & Petty, 1989), and familiar messages are associated with greater acceptance of strong arguments (Moons, Mackie, & Garcia-Marques, 2009). Consequently, using repeated exposure to a manipulation that has been shown to reduce craving ratings (Atwell et al., 2014) might be more effective in changing complex alcohol-related beliefs (i.e., alcohol-related outcome expectancies) than using single exposure.

3.2.2.Targeting "At-Risk" Groups

The majority of alcohol-related harms and problems tend to be reported by the drinkers that are not considered to be "at-risk" (i.e., individuals that are not drinking the highest levels of alcohol consumption) due to the larger proportion of the population being at a lower levels risk (Weitzman & Nelson, 2004). However, as shown by Romelsjö and Danielsson (2012) this paradoxical observation for alcohol-related problems may depend on the alcohol consumption behaviour being considered. For instance, they found that the majority of alcohol-related problems in adolescents were explained by lower risk drinkers and monthly heavy episodic drinking behaviour (HED; drinking ≥1/2 bottle of spirits, 1 bottle of wine, 4 cans (50 cl) of strong beer, or 6 cans of medium-strong beer on a single occasion), and that the proportion of problems accounted for by HED increased with age. A large proportion of the lower risk drinkers reported engaging in HED behaviour despite consuming lower volumes of alcohol in general. As such, specific alcohol-related behaviour, and not just alcohol intake in general, need to be considered in interventions. Importantly, it is generally agreed that population-level and high-risk intervention strategies be used in unison. Consequently, researchers should continue to examine the efficacy of evidence-based interventions that are targeted at individuals most at risk (Kok, Schaalma, Ruiter, Empelen, & Brug, 2004).

Using targeted interventions is not new practice; previous alcohol-related interventions have been targeted at high-risk drinkers (Baer, Kivlahan, Blume, McKnight, & Marlatt, 2001), at-risk age groups (Thush et al., 2007), and risk-related personality traits (Conrod, Castellanos & Mackie, 2008). Undergraduate students can be considered as a risk group. Following a review of 18 studies, Gill (2002) concluded that significant numbers of UK students drink to excess. First year undergraduates have been

shown to drink more than students in subsequent years (Bewick et al., 2008) and non-university attending peers (Kypri, Cronin, & Wright, 2005).

Alcohol use among the student population has been extensively examined (e.g., Courtney & Polich, 2009; Gill, 2002; Wicki, Kuntsche, & Gmel, 2010). Demographic factors such as having a lower age (e.g., Paschall & Saltz, 2007), being single (e.g., Sun, Maurer, & Ho, 2003), white (e.g., Heather et al., 2011), male (e.g., Neighbors, Lee, Lewis, Fossos, & Larimer, 2007), and living on campus (Wechsler, Lee, Nelson, & Kuo, 2002) have all been shown to predict higher levels of alcohol consumption. Specific high-risk groups within the student population have also been targeted with intervention, including intercollegiate athletes (LaBrie, Hummer, Huchting, & Neighbors, 2009) and members of fraternities and sororities at US universities (Larimer et al., 2001). A high-risk group that has not been previously identified within the student population may be those that hold high positive and low negative alcohol-related outcome expectancy beliefs.

3.2.3.Naturalistic Measure of Alcohol Consumption

Drinking behaviour is contextually specific; students drink in a variety of locations (Kypri, Paschall, Langley, Baxter, & Bourdeau, 2010) and rarely drink alone (e.g., Christiansen, Vik, & Jarchow, 2002). As a result, examining solitary alcohol consumption in a laboratory may not reflect natural drinking behaviour and offering free alcohol within this context may be associated with increased consumption (e.g., Strickler, Dobbs, & Maxwell, 1979). An alternative measure of alcohol consumption behaviour is the daily drinking diary. Leigh (2000) states that drinking diaries have a number of advantages, including reducing retrospective biases and memory loss for drinking occasions.

3.2.4. The Present Study

In summary, this study examines the immediate effects of a script-driven negative alcohol-related outcome expectancy imagery manipulation on craving,Hi Do and repeated manipulation exposure on alcohol-related cognitions and alcohol consumption as measured by daily drinking diaries. In addition to measuring outcome expectancies and craving, manipulation effects on mood, attentional bias, and implicit negative and positive expectancy associations were also examined. Outcome expectancies reflect affective states (Stein et al., 2000), which have been associated with craving (Cooney, Litt, Morse, Bauer, & Gaupp, 1997; Litt, Cooney, Kadden, & Gaupp, 1990; Willner, Field, Pitts, & Reeve, 1998) and alcohol consumption (Stein et al., 2000). As such, mood was measured to determine whether any changes in drinking levels and craving could be attributable to a change in affective state.

Wiers et al. (2006) argues for the use of implicit measures of cognition in addition to explicit measures when examining drug-related behaviour. Consequently, the manipulation effects on Visual Probe Task performance (VPT; e.g., Townshend & Duka, 2001) and a modified version of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) were measured. The VPT measures attentional bias towards alcohol-related stimuli and is associated with consumption behaviour (Townshend & Duka, 2001). The modified IAT measured implicit positive and negative expectancy associations with alcohol. Previous alcohol-related modifications of the IAT have shown that implicit and explicit measures of associations are related to, but can also explain unique variance in, alcohol consumption (e.g., Ostafin & Palfai, 2006).

This study examined the effect of a negative imagery script-guided outcome expectancy manipulation on expectancies, craving, implicit alcohol-related cognitions, and alcohol consumption. It was predicted that participants allocated to the negative

script condition would show immediate reductions in craving. Following repeated exposure, negative script participants were expected to demonstrate lower self-reported positive expectancies, craving, positive mood, attentional biases, and implicit positive expectancies, and higher self-reported negative expectancies and implicit negative expectancies, compared to participants allocated to a neutral condition. Participants in the negative condition were also predicted to consume less alcohol than individuals in the neutral condition following the manipulation.

3.3. Method

3.3.1. Participants

Forty first year undergraduate students (50% female), aged 18-25 years old (M = 18.73 years, SD = 1.55 years), were recruited to participate in a 3 week alcohol diary study from a UK campus university using advertisements via email and the university online research participation scheme. Eligibility to participate was determined using an online screening questionnaire and medical questionnaire. Eligible participants exceeded the weekly-recommended alcohol consumption guidelines (≥ 14 units per week for females or ≥ 21 units per week for males), had high positive alcohol-related outcome expectancies (i.e., a mean score ≥ 4 for all positive expectancy items in the Comprehensive Effects of Alcohol questionnaire; CEOA; Fromme, Stroot, & Kaplan, 1993), and had lower negative than positive expectancies (i.e., a mean score for all negative expectancy items in the CEOA to be lower than the mean score for all positive expectancy items). All participants included in the study were required to possess a mobile phone to receive text message reminders and prompts. As this study examined alcohol consumption behaviour, participants that indicated that they were not in good health, taking any medication (excluding the contraceptive pill), had a history of alcohol

or drug abuse, were pregnant, or breastfeeding were excluded from the study. To ensure that participants could understand study materials, participants were also excluded if they were not a native English speaker. An equal number of males and females were assigned to the negative script (n = 20) or neutral script condition (n = 20). Allocation was stratified based on the screening questionnaire responses to ensure group equivalence at baseline. Participant characteristics are shown in Table 1. Participants were given £20 or 18 research credits to compensate for their time spent in the laboratory.

3.3.2. Questionnaires

Online screening questionnaire. First year undergraduates were invited to complete an online screening questionnaire (Appendix L), which included alcohol consumption, alcohol-related outcome expectancy, and demographic items to determine eligibility for the study. Level of risk associated with alcohol consumption was assessed using ten 3- or 5-point response scales (that yield a possible score of 40) from the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). Higher scores on items measuring alcohol consumption, negative consequences, and behaviours indicative of dependence signify the level of risk associated with alcohol consumption (8-15 - hazardous drinking, 16-19 - harmful drinking, 20+ - possible dependence, warranting further diagnostic testing).

The Alcohol Use Questionnaire (AUQ; Mehrabian & Russell, 1978) was used to assess alcohol use from 18 items that measure the number of different types of alcoholic beverages consumed in a typical week, speed of drinking, number of times intoxicated in the past six months, and percentage of times drunk when drinking. The number of units consumed in a typical week was calculated from responses to the AUQ by estimating a glass of wine to be the equivalent of 2.1 units, a pint of beer at 2.3 units, a

pint of cider at 2.8 units, a single measure of spirit at 1 unit, and a bottle of alcopop at 1.4 units. Respondents exceeding weekly-recommended alcohol consumption guidelines (≥ 14 units per week for females or ≥ 21 units per week for males) were eligible to participate in the study.

Thirty-eight items from the Comprehensive Effects of Alcohol questionnaire (CEOA; Fromme et al., 1993; Appendix C) were used to derive composite mean scores for positive, and negative, alcohol-related outcome expectancies. Mean scores were calculated from all items relating to positive expectancies (liquid courage, sociability, sexuality, and tension reduction), and all items relating to negative expectancies (cognitive and behavioural impairments, risk and aggression, and self-perception). Participants were asked to indicate how they would feel under the influence of alcohol on 7-point response items (e.g., "I would feel courageous"; 1 - strongly disagree, 7 - strongly agree). Respondents were eligible to participate if they had a mean composite positive expectancy score of ≥ 4, and a mean composite negative expectancy score that was lower in number than their positive expectancy score. Kline's (1999) recommended Cronbach's alpha (α) cut-off score of ≥ .7 indicated that the composite positive expectancy scale (α = .74), and composite negative expectancy scale (α = .75) had good internal consistency.

Demographic measures including sex, age, year of study, accommodation type, sexuality, relationship status, and ethnicity were also included.

General health. Nine items from The Nuffield's Medical History Questionnaire (Appendix B) assessed health status, including whether individuals had experienced various illnesses, current medication usage, and general health status.

Alcohol-related outcome expectancies. Thirty-eight items from the CEOA (as described above; Fromme et al., 1993) were randomised and presented on a computer

screen during the study sessions. Mean scores were calculated for the four positive and three negative expectancy scales, and composite positive and negative expectancy scales. The calculated Cronbach's alphas indicated that seven of the nine scales had good reliability when completed at time 1 and 2. Specifically, the sociability (time 1, α = .77; time 2, α = .88), tension reduction (time 1, α = .73; time 2, α = .83), liquid courage (time 1, α = .79; time 2, α = .82), cognitive and behavioural impairments (time 1, α = .80; time 2, α = .89), risk and aggression (time 1, α = .81; time 2, α = .87), composite positive (time 1, α = .71; time 2, α = .85), and composite negative (time 1, α = .80; time 2, α = .89) expectancy scales were all shown to have good internal consistency. The sexuality and self-perception expectancy scales were shown to have slightly questionable reliability at time 1, but good reliability at time 2 (time 1, α = .67; time 2, α = .82, and time 1, α = .61; time 2, α = .82, respectively). Since the sexuality alpha did not deviate considerably from Kline's (1999) recommended cut-off score of .7, the scale was retained for subsequent analyses. The self-perception scale was also retained, but subsequent findings were considered with caution.

Craving. Mean scores for strong desires and intentions, mild desires, control over drinking, and negative reinforcement factors were calculated from 14 statements in the Desires for Alcohol Questionnaire (DAQ; Love, James, & Willner, 1998; Appendix D). The control over drinking items were reverse-coded to provide a score that reflected loss of control. Statements were randomised and presented on a computer screen to ask participants how they felt about drinking on seven-point response scales (e.g., "I want a drink so much I can almost taste it"; 1 - strongly disagree, 7 - strongly agree).

Three of the four craving scales were shown to have good internal consistency at the six time points of completion. Specifically, the strong desires and intentions to drink alcohol (time 1, α = .77; time 2, α = .76; time 3, α = .81; time 4, α = .77; time 5, α = .79;

time 6, α = .84), mild desires (time 1, α = .92; time 2, α = .93; time 3, α = .96; time 4, α = .95; time 5, α = .96; time 6, α = .93), and negative reinforcement scales (time 1, α = .73; time 2, α = .75; time 3, α = .81; time 4, α = .84; time 5, α = .88; time 6, α = .86) had good reliability. Loss of control over drinking was shown to have poor or questionable reliability at time 1 (α = .46), 2 (α = .21), 4 (α = .67), 5 (α = .37), and 6 (α = .49), but good reliability at time 3 (α = .89). The loss of control factor is calculated from two reverse-scored items; "if I started drinking now I would be able to stop" and "I could easily limit how much I would drink if I drank now." Therefore, these items were treated as separate factors in the subsequent analyses; loss of control over stopping and loss of control over limiting.

Mood. Two composite scores were calculated from the mean scores of eight original factors (anxiety, depression, anger, vigor, fatigue, confusion, friendliness, and elation) derived from the 72 items in the Profile of Mood States questionnaire (POMS; McNair, Lorr, & Droppleman, 1971; Appendix E). Adjectives were randomised and presented on a computer screen. Participants were asked to respond to 5-point response scales to examine how well the adjective represented their current mood state (e.g., "Anxious"; 1 - not at all, 5 - extremely). Arousal ((anxiety + vigor) – (fatigue + confusion)) and positive mood (elation – depression) were calculated as described by de Wit and Doty (1994).

Imagery script ratings. Three, 7-point items, created for the purpose of evaluating the imagery scripts (Appendix F), measured the degree to which participants were able to imagine themselves in their given script (1 - not at all; 7 - extremely well), the degree to which participants were able to relate to their given script (1 - not at all; 7 - extremely well), and the extent to which the script was considered as negative or positive (1 - extremely negative; 7 - extremely positive).

Alcohol consumption. A 7-day drinking diary, designed for the purpose of this study, was provided to participants at the end of three of the study sessions. For each day, participants were asked to record the amount of alcohol they had consumed and state whether they perceived themselves as being intoxicated (Appendix M). A list of drink types (e.g., spirits, cider, standard lager/beer) were provided in a table to prompt participants to be specific about the drinks they consumed, and the table was divided into AM, PM, and after midnight, to prompt participants to consider the times at which they consumed alcohol. Written instructions at the top of each page, encouraged participants to specify the volume they consumed (e.g., single measure, double measure, bottle, pint).

Using the drinking diaries, alcohol consumption was quantified as the total number of units, peak number of units during one day, frequency of drinking days, frequency of intoxication, and frequency of binge drinking (> 8 units during one drinking occasion for men, > 6 units during one drinking occasion for women) per week.

3.3.3. Computer Tasks

Attentional bias. A bias score was calculated for each participant by subtracting the mean reaction time (RT) for responses to a probe replacing alcohol-related pictures from the mean RT for responses to a probe replacing stationery-related pictures during the visual probe task (VPT; see Townshend & Duka, 2001).

Twenty pairs of alcohol- and stationery-related pictures, matched in complexity and design, and twenty pairs of filler pictures, selected on the basis of low arousal and neutral affect, were randomised and presented on a computer screen using E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). Each picture pair was presented

four times, allowing each picture to appear on the left and right side of the screen and to be replaced by a visual probe (dot) or not.

Written instructions on the screen informed participants that reaction times would be measured, a fixation cross would appear on the centre of the screen followed by a pair of pictures, and that one of these pictures would be replaced by a dot. The task was to respond to the dot by pressing the "A" key if it replaced the picture on the left or the "L" key if it replaced the picture on the right. They were asked to keep a finger on the response keys at all times, and to respond as quickly and as accurately as possible. Following the offset of the written instructions, the fixation cross was presented for 500ms followed by the picture pair for 500ms. A dot replaced one of the pictures and remained on the screen until the participant responded. An interval of 1000ms followed the offset of the dot, before the next trial began. Ten practice trials were given prior to the 160 test trials.

Incorrect responses and reaction times that exceeded 2000ms or two standard deviations above the mean were excluded from the analysis (e.g., Field & Eastwood, 2005). High positive bias scores represent strong attentional bias toward alcohol-related stimuli.

Implicit associations. Positive (P-IAT) and negative implicit association task (N-IAT) scores were calculated for each participant using an algorithm described by Greenwald, Nosek, and Banaji (2003). Scores were derived from reaction time latencies during combination blocks of two modified versions of the original implicit association task (IAT; Greenwald et al., 1998) that were created for the purpose of this study. Higher association scores represent a stronger association between alcohol and the alcohol-related state.

Associations between positive alcohol-related states (designed to reflect positive alcohol-related outcome expectancies) and alcohol, and between negative alcohol-related states (designed to reflect negative alcohol-related outcome expectancies) and alcohol were measured. Participants categorised target-relevant and/or attribute-relevant words presented in the centre of the computer screen to a category presented on the top left-hand corner or top right-hand corner of the screen. Target categories were presented in uppercase (ALCOHOL and SOFT DRINK) and attribute categories were presented in lowercase (positive and negative). Six target-relevant words (e.g., VODKA, WATER, GIN) and six attribute-relevant words (e.g., dizzy, fun, withdrawn) were shown in the same case as the associated category and displayed twice during each block of trials (see Appendix N for full list of target and attribute words).

Participants were given written instructions at the beginning of each block of trials to explain that categories would be presented and that they were to categorise the word that appears in the centre of the screen to the category on the left using the "A" key or the category on the right using the "L" key. They were asked to keep a finger on the response keys at all times, and to respond as quickly and as accurately as possible. Following the offset of the instructions, categories were shown on the computer screen for 250ms before the first word appeared in the centre of the screen. The word remained on the screen until the participants provided the correct response. If the incorrect response was given, an error message appeared. An interval of 250ms followed the offset of each word before the next trial began.

Each IAT consisted of 12 blocks of trials; 2 target discrimination blocks, 2 attribute discrimination blocks, then 3 combination blocks followed by a further 2 target discrimination blocks (where categories were switched to the opposite location), and 3 combination blocks (with the categories in the new positions). During discrimination

blocks, participants categorised target-relevant or attribute-relevant words. During combination blocks, participants categorised target-relevant and attribute-relevant words into the appropriate category (two categories are displayed on each side of the screen). A practice block was given for each new set of discrimination and combination blocks.

3.3.4. Alcohol-Related Outcome Expectancy Intervention

Imagery scripts. A gender-specific, negative alcohol-related imagery script that aimed to bolster negative alcohol-related outcome expectancies and contradict positive alcohol-related expectancies (Appendix G), and a neutral imagery script matched in length and complexity (Appendix I), were created for the study. The negative script led participants to imagine a night out at a club with their new flat mates during the first few weeks of term, and the neutral script led participants to imagine going to a café with their new flat mates during the first few weeks of term.

During the negative script the participant is primed to expect to experience cognitive and behavioural impairments (e.g., "you feel tipsy; you're dizzy and find that you're more clumsy than usual"), increased aggression (e.g., "Unable to control your anger you push him aggressively in the chest and shout at him"), and negative self-perception (e.g., "You exchange banter with one of your flat mates but take offence and feel self-conscious and stupid"). They are also primed to expect increased tension (e.g., "you're tense and regret coming out at all"), an inability to socially interact (e.g., "The alcohol has made it difficult to follow conversation and you're slurring your words"), unattractive behaviour (e.g., "you realise how unattractive your behaviour is"), and loss of confidence (e.g., "Your cheeks flush red with embarrassment and you lose your confidence").

Text message & e-mail prompts. Two text messages sent between sessions one and two, and between sessions three and four, reminded participants to keep up to date with their drinking diary. Two text messages sent between sessions two and three asked participants to respond to an email (sent at the same time) from the researcher within the next 24hrs. The email requested a recollection of the imagery script received during session two (see Appendix O for text message and email content).

Script recall. A recall score sheet, created for the purpose of this study, was used to score script recollections (Appendix P). The number of details remembered from a total of 43 pieces of information was recorded.

3.3.5. Procedure

Following ethical approval (granted by the School of Life Sciences Research Governance Committee at the University of Sussex; Appendix Q), eligible participants from the screening questionnaire were invited to participate in the 3-week alcohol diary study. The study consisted of four laboratory sessions conducted on the same day and time for four consecutive weeks; sessions one and four lasted approximately 20mins, and sessions two and three lasted approximately 1hr each.

Session 1. Participants were given an information sheet and consent form to sign before being seated in an individual cubicle with a computer to complete the DAQ, POMS, and medical history questionnaire. They were then shown the first drinking diary and instructed on how to complete it. Between sessions one and two, two text messages were sent to remind participants to complete their diary.

Session 2. Participants were asked to return their first drinking diary and provide a breath alcohol content (BrAC) sample using a hand-held breathalyser (Lion Alcolmeter® SD-400, Lion Laboratories Ltd, Barry, UK) to ensure a nil reading (0.0mg/l). They were then asked to complete the DAQ, POMS, and CEOA, before an

equal number of males and females from each condition completed the VPT, followed by the IATs, or vice versa. The DAQ and POMS were completed again before participants listened to their assigned negative or neutral imagery script. They then completed imagery script ratings and the DAQ and POMS once more. Participants were asked to recall as much information from the script as possible while the researcher recorded their responses using the recall score sheet. Correct answers were reviewed with the participant and omissions were highlighted before providing the second drinking diary. Between sessions two and three, two text messages were sent to participants to ask that they check their email. The emails requested a recollection of the imagery script via email within the next 24hrs and reminded them to keep up to date with their diary.

Session 3. Participants were asked to provide their second completed drinking diary and a BrAC reading to ensure a nil reading (0.0mg/l). The DAQ, POMS, CEOA, VPT, and IATs were completed in the same order as session two, and participants were asked to recall the script. Finally, the DAQ and POMS were provided once more before providing the final drinking diary. Between sessions three and four, two drinking diary reminder text messages were sent.

Session 4. The third completed drinking diary was collected and participants were debriefed.

3.3.6. Statistical Analysis

Prior to the statistical analyses, the data was examined to ensure parametric assumptions were met. In instances where assumptions were violated, transformations were utilised. If outliers were detected, and transformations did not correct violations, the value was replaced with the next highest/lowest score plus one or the mean value plus or minus two standard deviations (Field, 2005). Non-parametric statistics were

used if transformations could not correct for violations against parametric assumptions, and no outliers were present in the data. A *p*-value of .01 was used to indicate significant results due to multiple comparisons used in the statistical analyses. Where appropriate, effect sizes are presented and discussed.

Baseline equivalence. To examine baseline equivalence between groups, chi-square, independent samples *t*-tests, or Mann-Whitney tests were performed on demographic and baseline mean score data with condition as the between-subjects factor (negative or neutral).

Immediate manipulation effects on craving. To examine the immediate effects of the manipulation on craving, a series of one-way analyses of covariance (ANCOVA) were used to determine between-group differences immediately following the imagery script manipulation after controlling for pre-manipulation craving. ANCOVA are generally preferred to examining change from baseline scores when examining pre-post differences with two or more groups (e.g., Senn, 2006; Van Breukelen, 2006).

Prior to each ANCOVA, bivariate correlation analyses were performed to determine the utility of adding theoretically relevant covariates (e.g., alcohol consumption measures, the ability to imagine/relate to the given script) to improve the accuracy of the model. Covariate inclusion was dependent on a significant association with the dependent variable and no significant association with other covariates. The corresponding pre-manipulation measure was prioritised as a covariate followed by the magnitude of effect (Pearson's *r*) on the dependent variable.

Repeated manipulation effects on alcohol-related cognition and alcohol consumption. To examine the effects of repeated manipulation exposure on expectancies, craving, mood, attentional bias, implicit associations, and alcohol consumption a series of one-way ANCOVA were utilised. Using the same method as

above, pre-manipulation measures were entered a covariate and other theoretically relevant measures were considered for inclusion.

3.4. Results

3.4.1. Baseline Equivalence

Demographic and baseline mean scores are shown in Table 1. Ten males and ten females were allocated to each condition. However, after initial inspection of the data, all responses for one male participant in the negative condition were removed from the analyses. This was primarily due to the dubious excessive amount of alcohol reported for week one in the drinking diary (> 100 units) compared to other participants. The majority of the remaining participants were single (74%), heterosexual (85%), white (95%), and lived on campus (92%).

The Kolmogorov-Smirnov test indicated that the frequency distributions for several measures at baseline violated the assumption of normality. Consequently, log transformations were used to correct the distribution of AUQ scores ($D = 0.15$, $p = .20$), strong desires ($D = 0.17$, $p = .17$), positive mood ($D = 0.15$, $p = .20$), and number of drinking days (following the replacement of an outlier with the next lowest value minus one; $D = 0.16$, $p = .16$). An extreme outlier in the attentional bias score data was replaced with the mean value plus two standard deviations ($D = 0.16$, $p = .20$), and non-parametric tests were used to examine baseline differences in the number of days intoxicated, binge drinking days during week one, tension reduction expectancies, and loss of control over stopping alcohol consumption. There were no significant differences between groups on any of the demographic or baseline measures.

Table 1. Participant characteristics for each condition. Mean with standard deviation, or frequency with percentage, in parentheses given.

	Condition		
	Negative (n = 19)	Neutral (n = 20)	
Age	18.37 (0.60)	18.65 (0.81)	$t(37) = -1.23$, $p = .23$
Relationship Status (n = 38)			
Single	14 (74%)	14 (70%)	
In a Relationship	5 (26%)	4 (20%)	
Other	0 (0%)	1 (5%)	$X^2(2, N = 38) = 1.11$, $p = .57$
Sexuality			
Heterosexual	16 (84%)	17 (85%)	
Homosexual	0 (0%)	1 (5%)	
Bisexual	2 (11%)	1 (5%)	
Rather not say	1 (5%)	1 (5%)	$X^2(3, N = 39) = 1.34$, $p = .72$
Ethnicity			
White	18 (95%)	19 (95%)	
Mixed	1 (5%)	0 (0%)	
Indian	0 (0%)	1 (5%)	$X^2(2, N = 39) = 2.00$, $p = .37$
Accommodation Type			
On Campus	18 (95%)	18 (90%)	
University Managed Off Campus	1 (5%)	0 (0%)	
Privately Rented	0 (0%)	2 (10%)	$X^2(2, N = 39) = 2.98$, $p = .23$
Alcohol Consumption			
AUDIT Total Score	14.00 (4.56)	14.95 (5.14)	$t(37) = -0.61$, $p = .55$
AUQ Total Score [a]	74.09 (42.22)	74.81 (29.73)	$t(37) = -0.39$, $p = .70$
Week 1 Diary: Number of Units	33.78 (15.61)	25.98 (12.98)	$t(37) = 1.70$, $p = .10$
Week 1 Diary: Peak Number of Units	16.53 (7.79)	14.28 (6.68)	$t(37) = 0.97$, $p = .34$

Week 1 Diary: Frequency of Drinking Days [a, b]	3.79 (1.51)	3.20 (1.36)	$t(37) = 1.24$, $p = .22$
Week 1 Diary: Frequency of Intoxication	1.58 (1.02)	1.35 (1.14)	$U = 162.50$, $p = .42$
Week 1 Diary: Frequency of Binge Drinking	1.95 (0.85)	1.60 (0.88)	$U = 147.50$, $p = .21$
Outcome Expectancies			
Sociability	5.70 (0.58)	5.77 (0.55)	$t(37) = -0.34$, $p = .74$
Tension Reduction	4.07 (0.78)	4.33 (1.29)	$U = 160.50$, $p = .40$
Liquid Courage	4.25 (0.67)	4.69 (0.86)	$t(37) = -1.76$, $p = .10$
Sexuality	3.75 (0.85)	4.14 (1.02)	$t(37) = -1.29$, $p = .21$
Impairments	4.35 (0.57)	4.62 (0.75)	$t(37) = -1.30$, $p = .20$
Risk & Aggression	3.65 (0.97)	3.86 (1.04)	$t(37) = -0.64$, $p = .52$
Self-Perception	3.22 (0.86)	3.26 (1.05)	$t(37) = -0.13$, $p = .90$
Positive Expectancies	4.71 (0.43)	4.95 (0.56)	$t(37) = -1.53$, $p = .14$
Negative Expectancies	3.90 (0.51)	4.11 (0.70)	$t(37) = -1.04$, $p = .31$
Craving			
Strong Desires [a]	2.20 (0.87)	2.36 (0.91)	$t(37) = -0.52$, $p = .60$
Mild Desires	3.39 (1.69)	3.65 (1.49)	$t(37) = -0.50$, $p = .62$
Loss of Control over Stopping	1.47 (0.61)	1.70 (1.17)	$U = 190.00$, $p = .99$
Loss of Control over Limiting	2.16 (1.54)	1.95 (1.15)	$U = 189.00$, $p = .98$
Negative Reinforcement	2.92 (1.24)	3.20 (1.18)	$t(37) = -0.72$, $p = .48$
Mood			
Arousal	0.17 (1.63)	-0.15 (1.74)	$t(37) = 0.59$, $p = .56$
Positive Mood [a]	1.37 (1.36)	1.37 (1.22)	$t(37) = -0.15$, $p = .88$
Attentional Bias			
Visual Probe Bias Score [c]	5.00 (20.68)	-3.26 (15.87)	$t(36) = 1.39$, $p = .17$
Implicit Associations			
Positive implicit associations	0.07 (0.36)	0.11 (0.44)	$t(37) = -0.32$, $p = .75$
Negative implicit associations	0.12 (0.31)	0.04 (0.34)	$t(36) = 0.76$, $p = .45$

[a] Log transformation used; [b] Outlier replaced with the next lowest score plus one; [c] Outlier replaced with mean plus two standard deviations

3.4.2. Immediate Manipulation Effects on Craving

Unadjusted mean craving ratings before and after the manipulation are shown in Table 2. The frequency distributions for three of the five craving ratings were shown to significantly differ from normal and since transformations were not able to correct for these violations, non-parametric, rank analyses of covariance as described by Quade (1967) were performed. To determine the size of effect that condition had on each craving measure, Pearson's correlation coefficient (r) has been calculated, and Cohen's (1988; 1992) criteria where $r = .10$ indicates a small effect, $r = .30$ indicates a medium effect, and $r = .50$ indicates a large effect has been used to interpret the results.

There were no significant effects of condition on the craving scales immediately following the manipulation. With the exception of the loss of control scales, participants in both conditions showed reductions in craving following the manipulation. The largest effect of condition was observed for loss of control over limiting alcohol consumption. However, this effect size was still considered to be a small effect according to Cohen's (1988; 1992) criteria. According to the descriptive statistics, participants in the negative condition showed a slight reduction in their perceived loss of control over limiting their alcohol consumption immediately following the manipulation, while participants in the neutral condition showed a slight increase.

3.4.3. Repeated Manipulation Effects on Alcohol-Related Cognition

Unadjusted mean outcome expectancies, craving, mood, attentional bias, and implicit association scores, before and after repeated exposure to the manipulation, and the main effect of condition (ANCOVA) are shown in Table 3.

Outcome expectancies. The frequency distribution for negative participants' sociability expectancies violated the assumption of normality. Transformations did not correct this violation and no outliers were present in the data. As a result, rank analysis

Table 2. Unadjusted mean craving ratings before and immediately after first exposure to the imagery script with SEM in parenthesis. ANCOVA results for the main effect of condition on immediate post-manipulation scores after controlling for pre-manipulation scores (additional covariates indicated with superscript)

	Condition				
	Negative (n = 19)		Neutral (n = 20)		
	Before	After	Before	After	
Craving					
Mild Desires	3.53 (0.40)	3.05 (0.42)	3.75 (0.44)	3.53 (0.46)	$F(1,36) = 1.09$, $p = .30$, $r = .17$
Strong Desires	2.51 (0.24)	2.22 (0.23)	2.56 (0.25)	2.38 (0.22)	$F(1,36) = 0.66$, $p = .42$, $r = .13$
Loss of Control over Stopping [a]	1.89 (0.32)	2.42 (0.43)	2.35 (0.43)	2.55 (0.49)	$F(1,37) = 0.21$, $p = .65$, $r = .07$
Loss of Control over Limiting [a]	2.00 (0.32)	1.79 (0.28)	2.35 (0.39)	2.65 (0.41)	$F(1,37) = 3.95$, $p = .05$, $r = .27$
Negative Reinforcement [a]	2.64 (0.28)	2.32 (0.24)	2.91 (0.23)	2.55 (0.25)	$F(1,37) = 0.30$, $p = .59$, $r = .09$

[a] Rank analysis of covariance used

of covariance was conducted. The ability to relate to the imagery script was significantly associated with liquid courage expectancies at time 2 ($r(36) = -.43$, $p = .008$), but not time 1 ($r(37) = -.29$, $p = .07$). As such, this was included as a covariate in the subsequent analysis.

There were no significant effects of condition on the expectancy scales following repeated exposure to the manipulation. Participants in the negative condition showed reduced ratings for composite positive expectancies and the majority of the individual positive expectancy scales, while participants in the neutral condition showed slight increases. Participants also showed increases in composite negative expectancies and the majority of individual negative expectancy scales, while participants in the neutral condition showed slight decreases. The largest effects were observed for composite negative expectancies, followed closely by self-perception expectancies and cognitive and behavioural impairment expectancies. However, these effect sizes were still considered to be small in magnitude, and the findings relating to self-perception ratings should be treated with caution due to the questionable internal consistency demonstrated for this scale.

Craving. The frequency distributions for strong desires and intentions to drink alcohol, loss of control over stopping alcohol consumption, and loss of control over limiting alcohol consumption violated the assumption of normality. Log transformations were shown to correct the violation for strong desires ratings ($D = 0.19$, $p = .07$). No transformations could correct the loss of control ratings and no outliers were present in the data. As a result, rank analyses of covariance were used. The frequency of intoxication during week two was significantly associated with mild desires ratings following repeated exposure to the manipulation ($r(35) = -.37$, $p = .03$), but not before

Table 3. Unadjusted mean alcohol-related measure scores before and after repeated exposure to the imagery script with SEM in parenthesis. ANCOVA results for the main effect of condition following repeated exposure to the manipulation after controlling for pre-manipulation scores (additional covariates and transformations used indicated with superscript)

	Condition				
	Negative (n = 19)		Neutral (n = 20)		
	Before	After	Before	After	
Outcome Expectancies					
Sociability [a]	5.93 (0.16)	5.76 (0.24)	5.79 (0.13)	5.83 (0.16)	$F(1,36) = 0.40$, $p = .53$, $r = .11$
Tension Reduction	3.68 (0.26)	3.61 (0.29)	4.18 (0.23)	4.23 (0.34)	$F(1,35) = 1.22$, $p = .28$, $r = .18$
Liquid Courage [b]	4.34 (0.24)	4.11 (0.29)	4.66 (0.22)	4.63 (0.27)	$F(1,34) = 1.13$, $p = .30$, $r = .17$
Sexuality	3.43 (0.20)	3.57 (0.27)	3.98 (0.23)	4.06 (0.27)	$F(1,35) = 0.00$, $p = .99$, $r = .17$
Impairments	4.49 (0.18)	4.81 (0.21)	4.54 (0.25)	4.39 (0.31)	$F(1,35) = 3.48$, $p = .07$, $r = .27$
Risk & Aggression	3.76 (0.26)	3.66 (0.27)	3.90 (0.26)	3.75 (0.33)	$F(1,35) = 0.11$, $p = .75$, $r = .05$
Self-Perception	2.64 (0.17)	2.99 (0.33)	2.95 (0.25)	2.75 (0.26)	$F(1,35) = 4.69$, $p = .04$, $r = .28$
Positive Expectancies	4.77 (0.10)	4.68 (0.17)	4.93 (0.12)	4.95 (0.15)	$F(1,34) = 0.43$, $p = .52$, $r = .11$
Negative Expectancies	3.88 (0.12)	4.08 (0.15)	4.01 (0.20)	3.85 (0.26)	$F(1,35) = 6.13$, $p = .02$, $r = .29$
Craving					
Mild Desires [c]	3.53 (0.40)	3.50 (0.40)	3.75 (0.44)	3.40 (0.46)	$F(1,33) = 0.22$, $p = .64$, $r = .08$
Strong Desires [d]	2.51 (0.24)	2.23 (0.20)	2.56 (0.25)	2.17 (0.23)	$F(1,36) = 0.33$, $p = .57$, $r = .09$
Loss of Control over Stopping [a]	1.89 (0.32)	1.58 (0.21)	2.35 (0.43)	1.65 (0.33)	$F(1,37) = 0.80$, $p = .38$, $r = .15$
Loss of Control over Limiting [a]	2.00 (0.32)	1.89 (0.30)	2.35 (0.39)	1.85 (0.30)	$F(1,37) = 0.39$, $p = .54$, $r = .10$
Negative Reinforcement	2.64 (0.28)	2.72 (0.28)	2.91 (0.23)	2.58 (0.29)	$F(1,36) = 1.28$, $p = .27$, $r = .04$
Mood					
Arousal	-0.13 (0.37)	0.87 (0.30)	-0.13 (0.32)	0.09 (0.44)	$F(1,36) = 2.76$, $p = .11$, $r = .25$
Positive Mood	1.40 (0.24)	1.46 (0.23)	1.35 (0.24)	1.21 (0.30)	$F(1,36) = 0.47$, $p = .50$, $r = .11$

Attentional bias					
Bias Score [a]	5.00 (4.87)	3.49 (5.27)	-3.26 (3.55)	1.53 (3.94)	$F(1,36) = 0.09$, $p = .77$, $r = .13$
Implicit Associations					
Positive Implicit Associations	0.07 (0.08)	0.07 (0.08)	0.11 (0.10)	0.01 (0.13)	$F(1,36) = 0.36$, $p = .55$, $r = .10$
Negative Implicit Associations [f]	0.12 (0.07)	0.16 (0.11)	0.04 (0.08)	0.09 (0.09)	$F(1,34) = 0.03$, $p = .87$, $r = .03$

[a] Rank analysis of covariance used; [b] Ability to relate to given script included as an additional covariate; [c] Frequency of intoxication during week two included as an additional covariate; [d] Log transformations used; [e] One extreme outlier removed; [f] Total AUQ score included as an additional covariate

($r(35) = -.29$, $p = .08$). As a result, this measure was included as a covariate in the subsequent analyses.

There were no significant effects of condition on the craving scales following repeated exposure to the manipulation, and the observed effect sizes were small. With the exception of the negative reinforcement scale, participants in both conditions showed reductions in craving following the manipulation.

Mood. There were no significant effects of condition on mood following repeated exposure to the manipulation. The descriptive statistics revealed that all participants showed increases in arousal scores, with participants in the negative condition showing a larger increase. Participants in the negative condition showed slight increases in positive mood, while participants in the neutral condition showed slight decreases. The effect of condition was largest for arousal scores, yet this still remained small in size.

Attentional bias. The distribution of attentional bias scores violated the assumption of normality, and since transformations could not correct this violation and no outliers were present in the data, rank analysis of covariance was used. The small effect size observed for condition on attentional bias scores failed to reach significance. Descriptive statistics indicated that bias scores for the participants in the negative condition reduced following the manipulation, while bias scores for the participants in the neutral condition increased.

Implicit associations. Total AUQ scores were significantly associated with implicit negative association scores following repeated exposure to the manipulation ($r(37) = -.39$, $p = .01$), but not before ($r(37) = -.04$, $p = .83$). As such, this variable was included as a covariate in the subsequent analysis.

There were no significant effects of condition on implicit association scores following repeated exposure to the manipulation. Negative participants' positive implicit association scores did not change following the manipulation, while neutral participants' scores were shown to decrease slightly. Negative implicit association scores for all participants were shown to increase following the manipulation.

3.4.3. Repeated Manipulation Effects on Alcohol Consumption

The unadjusted mean number of units, peak number of units, frequency of drinking days, frequency of intoxication, and frequency of binge drinking as measured by the alcohol diaries are shown in Table 4. The Kolmogorov-Smirnov test indicated that the frequency of intoxication in week two and three, and the frequency of binge drinking in week two and three violated the assumption of normality. Since no transformations could correct these violations and no outliers were present in the data, rank analyses of covariance were conducted. Total AUQ scores were significantly associated with the peak number of units consumed during week two ($r(36) = .36$, $p = .03$), but not week one ($r(37) = .27$, $p = .09$). As a result, this was included as an additional covariate in the subsequent analysis.

Analyses of covariance and rank analyses of covariance indicated that there was no significant effect of condition on alcohol consumption measures during week two (i.e., during repeated exposure to the manipulation) or three (i.e., following repeated exposure to the manipulation) after controlling for the corresponding alcohol consumption measure during week one. The descriptive statistics indicated that participants in the negative condition showed slight reductions in the number of units consumed, peak number of units consumed, and frequency of drinking days, but increases in the frequency of intoxication and binge drinking during the week of the manipulation. Participants in the neutral condition showed slight increases in the

Table 4. Unadjusted weekly alcohol consumption measures from the drinking diary with SEM in parenthesis.

	Group		
	Negative (n = 19)	Neutral (n = 20)	
Number of Units			
Week 1	33.78 (3.58)	25.98 (2.90)	
Week 2	30.91 (3.51)	27.80 (3.74)	$F(1,35) = 0.003$, $p = .96$, $r = .01$
Week 3	32.26 (4.68)	26.89 (4.24)	$F(1,36) = 0.01$, $p = .93$, $r = .01$
Peak Number of Units			
Week 1	16.53 (1.79)	14.28 (1.49)	
Week 2 [a]	14.68 (1.81)	13.30 (1.18)	$F(1,34) = 0.36$, $p = .56$, $r = .10$
Week 3	16.95 (2.20)	11.89 (1.19)	$F(1,36) = 3.11$, $p = .09$, $r = .26$
Frequency of Drinking Days			
Week 1 [b]	3.79 (0.35)	3.20 (0.30)	
Week 2	3.28 (0.30)	3.25 (0.32)	$F(1,35) = 1.09$, $p = .30$, $r = .17$
Week 3	2.84 (0.37)	3.30 (0.40)	$F(1,36) = 2.35$, $p = .13$, $r = .24$
Frequency of Intoxication			
Week 1	1.58 (0.23)	1.35 (0.25)	
Week 2 [c]	1.65 (0.24)	1.25 (0.31)	$F(1,35) = 0.27$, $p = .61$, $r = .09$
Week 3 [c]	1.32 (0.20)	1.40 (0.24)	$F(1,37) = 0.19$, $p = .67$, $r = .07$
Frequency of Binge Drinking			
Week 1	1.95 (0.19)	1.60 (0.20)	
Week 2 [c]	2.00 (0.27)	1.85 (0.27)	$F(1,36) = 0.003$, $p = .96$, $r = .01$
Week 3 [c]	1.74 (0.25)	1.65 (0.26)	$F(1,37) = 0.04$, $p = .84$, $r = .03$

[a] AUQ total score included as an additional covariate; [b] Outlier replaced with the next lowest score plus one; [c] Rank analysis of covariance used

number of units consumed, frequency of drinking days, and frequency of binge drinking, and decreases in the peak number of units consumed, and frequency of intoxication during the week of the manipulation. The observed effect sizes for week two alcohol consumption measures were small or negligible.

During week three, participants in the negative condition were shown to have consumed a slightly lower mean number of units and displayed a slight reduction in the frequency of drinking days, frequency of intoxication, and binge drinking occasions compared to week one. However, they also showed a slight increase in the peak number of units consumed during a single drinking session. Participants in the neutral condition showed increases in the mean number of units consumed, frequency of drinking days, frequency of intoxication, and binge drinking occasions compared to week one. However, they also showed a decrease in the peak number of units consumed during a single drinking session. The largest effect sizes were observed for the effect of condition on peak number of units consumed and the frequency of drinking days. Nevertheless, these effect sizes remained small in magnitude.

3.5. Discussion

This study examined the effects of an imagery script-driven manipulation that aimed to bolster negative outcome expectancies and contradict positive outcome expectancies on alcohol-related cognitions and alcohol consumption. Specifically, the study sought to replicate and extend upon previous findings relating to the immediate effects of the same manipulation on craving (Atwell et al., 2014). Repeated exposure to the manipulation was used to potentially increase manipulation effects on outcome expectancies, participants with high positive expectancies and low negative expectancies (i.e., those most “at-risk”) were targeted, and daily drinking diaries (rather than a laboratory-based measure of alcohol consumption) were utilised.

Findings relating to immediate manipulation effects on craving provided limited support for the previous study (Atwell et al., 2014) and the current hypothesis. While inferential statistics revealed no significant differences in craving ratings between the negative script and neutral script participants immediately following the manipulation, participants in the negative condition showed reductions in the majority of craving scales. However, with the exception of perceived loss of control over limiting alcohol consumption, participants in the neutral condition also displayed reductions. As such, the lack of significant effects observed in the analyses may be explained by these reductions in craving ratings observed for the neutral script participants.

Repeated exposure to the negative script manipulation was associated with higher ratings for the composite measure of negative expectancies and the majority of individual negative expectancy scales, and lower ratings for the composite measure of positive expectancies and the majority of positive expectancy scales. However, inferential statistics indicated that these changes, relative to participants in the neutral condition failed to reach significance. Again, these findings provided limited support for the hypotheses and the effects observed were small.

Outcome expectancies are continually developing from experiencing/learning the associations between alcohol and subsequent consequences. For example, if one were to experience increased confidence the majority of times that one drank alcohol, one will be likely to expect increased confidence as an outcome of future consumption. This is how outcome expectancies develop. Contradicting outcome expectancies through manipulation or intervention is challenging. The engrained associations between alcohol and subsequent consequences that may serve to motivate future consumption need to be interrupted. It was hypothesised that repeated exposure to the manipulation would have been associated with greater effects than a single-session

intervention used previously (Atwell et al., 2014). This hypothesis reflected previous health intervention literature that has demonstrated that multi-session interventions have an advantage over single-session interventions (e.g., Kuehl et al., 1993; Wolitski, 2006; Zhu et al., 1996). However, using scripted scenarios that portray negative outcomes of alcohol consumption are likely to be far less salient than personal experiences when drinking.

Importantly, the results did not support the remaining hypotheses. The manipulation was not associated with any changes in other alcohol-related measures. Specifically, there were no significant between-group differences in craving, mood, attentional bias or positive and negative implicit associations following repeated exposure to the manipulation.

While there was limited evidence for immediate manipulation effects on craving (as discussed above), this was no longer evident following repeated exposure. The DAQ (Love et al., 1998) has been validated previously in distinguishing between alcohol use disorder and non-alcohol use disorder participants (Kramer et al., 2010), and as a reliable measure of alcohol-induced craving (Courtney et al., 2013). However, as stated by Kavanagh and colleagues (2012), the questionnaire is limited to evaluating the current state of craving. As craving was not measured outside the laboratory session, it was impossible to infer whether the participants showed differential levels in craving in the week during repeated exposure.

Positive and negative expectancies reflect affective states (e.g., Stein et al, 2000) and previous research has demonstrated associations between mood and alcohol consumption (e.g., Cooney et al., 1997; Swendsen et al., 2000). Consequently, it was important to include this factor in our analysis to differentiate any potential mood effects on alcohol consumption from expectancy-related effects. The manipulation was

not shown to produce any between-group differences in mood following repeated exposure to the manipulation. However, as with the craving questionnaire, the POMS (McNair et al., 1971) is limited to measuring current mood state.

To counteract the limitation associated with measuring craving and mood out of context, future research may consider using the experience sampling method as described by Larson and Csikszentmihalyi (1983). This method asks participants to provide self-reported ratings at random occasions during the waking day. The use of modern technology, such as mobile phones, could be particularly helpful in implementing the methodology and might provide the researcher with the opportunity to measure a variety of outcomes with the advantage of reduced retrospective biases and memory loss.

Attentional biases towards drug-related stimuli are thought to reflect automatic, subconscious processes that result from the incentive salience of the drug (Robinson & Berridge, 1993). Biases have previously differentiated between heavy and occasional social drinkers (Townshend & Duka, 2001) and are also implicated in the initiation of alcohol consumption (Weafer, 2012). The manipulation used in this study did not significantly influence the automatic processes associated with alcohol consumption. In future, interventions may consider manipulating automatic processes in addition to altering controlled cognitive processes. For example, Wiers and colleagues (2010; 2011) were able to retrain automatic action-tendencies (or biases) towards alcohol by pushing a joystick (avoid) when alcoholic drinks were displayed on a screen and pulling a joystick (approach) when non-alcoholic drinks were displayed. This retraining has been associated with better condition treatment outcomes for alcoholics a year later when compared with control participants (Weir et al., 2011) and lower alcohol consumption in hazardous drinkers (Weir et al., 2010).

While other versions of the modified IAT have demonstrated its utility in alcohol-related research (e.g., Houben & Wiers, 2007; Palfai & Ostafin, 2003; Wiers et al., 2002), the version used in this study was exploratory and has not been previously validated. Of note, in the debriefing session many participants also stated that they thought the aim of the study was to examine positive and negative associations with alcohol based on this task. As such, its utility as an implicit measure could be questioned.

The expectancy manipulation used in this study was not associated with any significant between group differences in alcohol consumption as measured with daily drinking diaries. As such, the manipulation was ineffective at reducing subsequent drinking. In the previous single-session study (Atwell et al., 2014), no manipulation effects were observed on alcohol consumption during a taste test paradigm, and while daily drinking diaries are a more naturalistic measure of alcohol consumption, they are still associated with response bias. There is also some suggestion that behaviour may be reactive to self-monitoring techniques (e.g., Fremouw & Brown, 1980).

Some limitations of this study should be considered. First, this study utilized a number of subjective measures and as such, may be liable to response biases. The use of objective measures of craving such as psychophysiological responses (e.g., Sayette et al., 2000) and objective measures of alcohol consumption such as urine based biochemical liver function tests (Jain, Quraishi, Majumder, & Pattanayak, 2013) could be considered. Second, results indicate that the neutral imagery script condition was associated with reduced craving ratings following the manipulation. As such, an assessment only condition (i.e., participants who receive no imagery script) could be considered as an alternative or additional control group. Third, participants were asked to recall imagery scripts via email. It is possible that previous recall emails were used to

inform subsequent recollections. The use of a website may have avoided such potential contamination effects. Finally, due to the small sample size, this study severely lacked statistical power. A power analysis indicated that the study had 14% power to detect a medium effect with a .01 statistical significance criterion. This limitation may have been potentiated by the use of non-parametric statistics for some of the analyses due violations of parametric assumptions.

Despite these limitations, this study provided participants with a novel manipulation that required minimal face-to-face contact and could be easily translated into a computer-delivered intervention (CDI). CDIs have been shown to be more cost-effective than face-to-face techniques (McCrone et al., 2004; Ownby, Waldrop-Valverde, Jacobs, Acevedo, & Caballero, 2013) and as such, may be a practical solution for intervention dissemination among university students. Mobile phone technology for text message reminders and the use of e-mails to retrieve participant data were also integrated into this study. Mobile phone technology has been successfully used deliver a variety of health interventions (see Klasnja & Pratt, 2012). For example, mobile phones have provided tailored health-related messages to college smokers (Riley, Obermayer, & Jean-Mary, 2008), delivered depression prevention interventions to high school students (Whittaker et al., 2012), and monitor health outcomes in chronic disease (Blake, 2008). This study provides further support for the utility of modern technology in interventions, which may be a more preferred method on intervention delivery among students (Kypri, Saunders, & Gallagher, 2003).

This study provides limited support for previous findings associating a negative outcome expectancy imagery script manipulation with immediate reductions in craving (Atwell et al., 2014), and while repeated exposure to the manipulation was not associated with significant effects, the descriptive statistics did indicate that participants

in the negative condition showed changes in outcome expectancy ratings in the expected direction. Manipulation effects were not observed for any of the other alcohol-related measures or alcohol consumption. Alcohol-related interventions may need to consider the use of multiple or extensive sessions to reduce engrained alcohol-related beliefs and could consider retraining automatic processes in addition to challenging considered cognitive processes such as alcohol-related outcome expectancies.

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Chapter 4

A parsimonious, integrative model of key psychological correlates of UK university students' level of risk related to alcohol consumption

4.1. Abstract

This study examined the predictive utility of psychological correlates of alcohol consumption identified in previous (US dominated) research for a UK student sample, and provided an integrative model that predicts level of risk related to alcohol consumption among a sample of first year undergraduate students. A self-report questionnaire measured stable correlates including age at onset, personality traits, and religiosity. Modifiable determinants measured were drinking motives, self-efficacy, alcohol-related expectancies, prototype perceptions, and normative beliefs. Level of risk related to alcohol consumption was quantified using the Alcohol Use Disorder Identification Test (AUDIT). The model highlighted the importance of the age when first regularly drinking (age at onset), the sensation-seeking personality trait, and a series of social cognitive measures, including social drinking motives, confidence in ability to drink within government guidelines (self-efficacy), and the perceived quantity and frequency of alcohol consumed by university friends. Beta-coefficients indicated that self-efficacy and social drinking motives were particularly useful predictors. In addition, a significant interaction was observed between age at onset and self-efficacy. The interaction suggests that earlier age at onset is associated with lower levels of self-efficacy, and that lower levels of self-efficacy are associated with higher levels of risk related to alcohol consumption. The model presented here may help to identify students that are most likely to be drinking risky levels of alcohol, and help to inform which modifiable determinants might be best targeted within campus-based interventions.

4.2. Introduction

Becoming a university student is an exciting and daunting experience. In many universities, "Fresher's week" (or fortnight) represents initiation into this role, settling in to new accommodation, meeting new people, and attending promotional events before lectures begin. The combination of newfound independence, and new drinking norms learnt during "Fresher's week" and the first term, may contribute to the higher levels of alcohol consumption found among students compared to non-university-attending peers (Kypri, Cronin, & Wright, 2005), and among first year undergraduates compared to those in subsequent years (Bewick et al., 2008).

In a review of 18 alcohol consumption studies using UK undergraduates, Gill (2002) concluded that substantial numbers exceed government guidelines. Although this conclusion was based on a limited number of studies, using heterogeneous measures of consumption, the trend was clear. As are the implications; excessive alcohol consumption increases students' risk of short-term and long-term health consequences such as hangovers, cancers, liver damage, and depression (NHS, 2008), as well as resulting in lower academic attainment, and financial concerns (Bewick et al., 2008). Yet this is not how student drinkers typically construe excessive alcohol consumption. Drinking, and excessive drinking, is more commonly associated with having fun, socialising, and expressing oneself (Lee, Maggs, Neighbors, & Patrick, 2011; Park, 2004). Thus, in a context in which excessive alcohol consumption costs the UK national health services £2.7 billion per annum, and in which approximately one third of UK 18 year olds become university educated (Eason, 2010), more effective interventions are required. The UK House of Commons Health Committee's (2010) report on alcohol highlighted the problem of college/university cultures sustaining student drunkenness, and recommended that, "universities take a much more active role in discouraging

irresponsible drinking amongst students" (p. 21). The Chair of the Committee concluded that, "what is required is fundamental cultural change brought about by evidence- based policies; only this way are we likely to reduce the dangerous numbers of young people drinking their lives away".

Evidence-based interventions should be aimed at the individuals most at risk, and designed using good models of modifiable determinants (Bartholomew, Parcel, Kok, & Gottlieb, 2006; Kok, Schaalma, Ruiter, Empelen, & Brug, 2004). This study aimed to identify factors that predict risky alcohol consumption, by drawing on available evidence from a myriad of previously identified correlates (e.g., Courtney & Polich, 2009), and tested their predictive utility among a sample of UK undergraduates in the first term of university. A series of such correlates, including stable risk factors (i.e., age at onset, personality traits, and religiosity), and less stable, more modifiable determinants (i.e., drinking motives, self-efficacy, alcohol-related expectancies, prototype perceptions, and normative beliefs), have been identified.

4.2.1. Age at Onset

The age at which an individual begins to drink regularly is consistently associated with later alcohol consumption, alcohol dependence, and negative consequences associated with drinking. Strong evidence from a longitudinal study of more than 300 Finnish nationals showed earlier onset to be predictive of higher scores on four different alcohol consumption measures (drinking frequency, binge drinking, and two alcoholism screening tests; Pitkanen, Lyyra, & Pulkkinen, 2005). Although cross-sectional studies rely on the retrospective memory for age at onset and alcohol consumption behaviour, they provide further support for the relationship (Grant & Dawson, 1997; Grant et al., 2006; Hingson, Heeran, & Winter, 2006). Hingson and colleagues showed that earlier onset is also associated with greater injury after drinking

(Hingson, Heeran, Jamanka, & Howland, 2000), alcohol-related car accidents (Hingson, Heeran, Levenson, Jamanka, & Voas, 2002), and fighting after drinking (Hingson, Heeran, & Zakocs, 2001). By delaying the onset of drinking for a year, the prevalence of dependence and abuse as defined by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), can be reduced by 14% and 8%, respectively (Grant & Dawson, 1997).

4.2.2. Personality Traits

Sensation-seeking, defined by, "the need for varied, novel, and complex situations and experiences" (Zuckerman, 1979, p.10), has been shown to be positively correlated with risky behaviour (Horvath & Zuckerman, 1993), including alcohol consumption (Borsari, Murphy & Barnett, 2007; Grange, Jones, Erb, & Reyes, 1995; Grau & Ortet, 1999), and mediate the relationship between alcohol consumption and alcohol-impaired driving (McMillen, Adams, Wells-Parker, Pang, & Anderson, 1992; Zakletskaia, Mundt, Balousek, Wilson, & Fleming, 2009). Conversely, conscientiousness, exemplified by being meticulous, self-disciplined, and achievement-orientated, has been shown to positively correlate with preventive health behaviour (Ingledew & Brunning, 1999), and negatively associated with risky behaviour (Vollrath, Knoch, & Cassano, 1999; Gullone & Moore, 2000; Vollrath & Torgersen, 2002), including alcohol consumption (Cook, Young, Taylor, & Bedford, 1998; Kashdan, Vetter, & Collins, 2005).

4.2.3. Religiosity

Alcohol consumption has been shown to negatively correlate with religiosity (Cochran & Akers, 1989; Cochran, Beeghley, & Bock, 1988), indicating that individuals that affiliate strongly with religion, tend to drink less alcohol. The relationship between alcohol and religion has been found to be moderated by sex

(Poulson, Eppler, Satterwhite, Wuensch, & Bass, 1998), a partner's religion (Cochran, Beeghley, & Bock, 1992), and religious denomination (Bock, Cochran, & Beeghley, 1987; Cochran et al., 1988). However, it should be noted that this work has relied on widely heterogeneous measures, some of which (e.g., dichotomous measures), may obscure the religiosity-consumption relationship (Mason & Windle, 2002).

4.2.4. Drinking Motives

Inspired by Cox and Klinger's (1988) motivational model of alcohol treatment, Cooper (1994) developed a four-factor model of drinking motives including coping, conformity, enhancement, and social motivations, which has been found to be more effective than alternative motivational models (MacLean & Lecci, 2000), and to provide a useful model of motivation across different student ethnic groups (Martens, Rocha, Martin, & Serrao, 2008), and cultures (Kuntsche, Knibbe, Gmel, & Engels, 2006; Kuntsche, Stewart, & Cooper, 2008). Out of the four motives, enhancement, social, and coping motives have been found to be consistently associated with consumption levels and alcohol-related problems (Lyvers, Hasking, Hani, Rhodes, & Trew, 2010; Martens et al., 2008; Simons, Correia, & Carey, 2000; Yusko, Buckman, White, & Pandina, 2008).

4.2.5. Self-Efficacy

Self-efficacy refers to the perceived confidence that an individual has in their ability to perform behaviour (Bandura, 1982; 1997), and is associated with alcohol consumption among students (Gilles, Turk, & Fresco, 2006; Oei & Jardim, 2007; Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2004). Although research into self-efficacy, and drinking has employed heterogeneous measures, including the confidence to refuse drinks (Oei & Jardim, 2007), and resist heavy drinking in a given social situation (Gilles

et al., 2006), findings have consistently indicated that lower self-efficacy is predictive of greater consumption. Self-efficacy has been shown to be amenable to change through intervention (e.g., McKellar, Ilgen, Moos, & Moos, 2008).

4.2.6. Alcohol-Related Expectancies

The concept of alcohol-related expectancies originates from a similar social learning background to drinking motives (e.g., Donovan, Molina, & Kelly, 2009), and can differentiate between low- and high-risk alcohol users (Fromme, Stroot, & Kaplan, 1993; Mann, Chassin, & Sher, 1987). Fromme et al. (1993) developed and validated an expectancy questionnaire consisting of seven expectancy scales including sociability, tension reduction, liquid courage, sexuality, cognitive and behavioural impairment, risk and aggression, and self-perception which can be divided into negative (the latter three scales) and positive expectancies (the former four). Mean scores for all of these scales were found to be significantly higher among heavy drinkers than abstainers and light drinkers. Furthermore, positive and negative expectancies have been found to differentiate between risky alcohol behaviours such as drinking game participation (Zamboanga, Schwartz, Ham, Borsari, & Van Tyne, 2010).

4.2.7. Prototype Perceptions

Perceptions of the typical drinker can also predict consumption (Gibbons & Gerrard, 1995; Spijkerman, Larsen, Gibbons, & Engels, 2010; Rivis & Sheeran, 2003). These prototypes may differ in similarity (i.e., how similar the individual feels that they are to the prototype) and favourability (i.e., how much they like or dislike the prototype). From the two given dimensions, prototype similarity may be especially important (Rivis, Sheeran, & Armitage, 2006). However, different prototypes have different predictive values for specified groups (Gerrard et al., 2002; Rivis, Abraham, & Snook, 2011).

4.2.8. Normative Beliefs

Research conducted in the US has emphasised the role of normative influences on student alcohol consumption (Borsari & Carey, 2001; 2003), and the potential of targeting peer norms in campus-based interventions (Perkins, 2002). Social norms are the "rules and standards that are understood by members of a group, and that guide and/or constrain social behaviour without the force of laws" (Cialdini & Trost, 1998, p. 152). As a result, norms act as subconscious guides to appropriate behaviour in a given context, with a particular reference group. A recent review by Borsari and Carey (2001), concluded that the more that students perceive others to drink (descriptive norm), and approve of drinking (subjective norm), the higher their own reported usage (see also; Beck & Treiman, 1996; Norman, Armitage, & Quigley, 2007; Perkins & Berkowitz, 1986; Sher, Bartholow, & Nanda, 2001). Further evidence for a social norm, alcohol consumption relationship is provided by intervention studies that have shown the reduction in alcohol-related risk behaviour to be mediated by a reduction in perceived norms (e.g., Neighbors, Lewis, Bergstrom, & Larimer, 2006).

4.2.9. Limitations of Previous Research

The majority of studies on the predictors of students' alcohol consumption have been conducted in the US. Consequently, these findings may, or may not, provide a good basis for UK interventions, depending on whether the findings generalise to the UK where different laws and pricing policies operate.

A further limitation is the heterogeneous, and sometimes, oversimplified self-report measures of alcohol consumption used by previous research. These vary from dichotomous "yes" or "no" responses, quantity and frequency measures, to the use of the DSM-IV criteria for alcohol dependence and abuse.

Finally, although a series of potentially modifiable correlates have been identified, few studies have attempted to integrate a range of correlates in one model to ascertain the relative strengths of these predictors.

4.2.10. Study Aims

On the basis of previous research, it was hypothesised that age at onset, conscientiousness, religiosity, and self-efficacy will be negatively associated with level of risk related to alcohol consumption, as measured by the Alcohol Use Disorder Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), while sensation-seeking, drinking motives, alcohol-related expectancies, prototype perceptions, and social norms will have a positive correlation with level of risk. This study examined whether modifiable determinants significantly improved the amount of variance explained after stable risk factors had been entered into the model, and whether normative beliefs (emphasised as a particularly important determinant) could explain a significant amount of variance after all other correlates were controlled for. The predictive utility of these correlates and their interactions were examined in a single study to develop a parsimonious model of key determinants in a UK undergraduate sample.

4.3. Method

4.3.1. Participants

230 students (52% female) aged 18-41 years old (M = 19.4yrs, SD = 2.7yrs) completed the questionnaire. The sample was predominantly white (85%), lived on campus (94%), and were not affiliated with any religion (60%). The majority (95%) drank alcohol. During a typical week, participants consumed an average of 20.2 (SD = 17.9) alcoholic beverages; the majority drank alcohol 2-3 times per week (45%), and

binge drank (defined as 6 or more units if female and 8 or more units if male) weekly (56%).

4.3.2. Materials and Measures

The questionnaire. The questionnaire (Appendix R) included a range of measures reflecting the findings reviewed above.

Alcohol consumption. An adapted version of the Alcohol Use Disorders Identification Test (AUDIT), developed by the World Health Organisation (WHO) to aid primary health care workers in identifying those at risk of alcohol dependence, was used. The AUDIT consists of 10 questions that yield a score of 0-4, with a possible total score of 40, and evaluates consumption levels (e.g., "How often do you have a drink containing alcohol?"), negative consequences (e.g., "Have you or somebody else been injured as a result of your drinking?"), and behaviours indicative of dependence (e.g., "How often since you began university did you need an alcoholic drink in the morning to get yourself going after a heavy drinking session?"). The AUDIT quantifies a broader spectrum of consumption behaviour than many previously used measures, and has been shown to be valid and accurate across different demographically defined groups (e.g., Babor etal., 2001). Previous research has used this measure to identify individuals that have a potential alcohol problem based on cut-off scores (e.g., Kokotailo et al., 2004), and/or to group individuals according to their score (e.g., Heather et al., 2011), with scores of 8-15 indicating hazardous drinking, 16-19 indicating harmful drinking, and 20+ indicating possible dependence that warrants further diagnostic testing. This study utilizes the AUDIT as a continuous scale with higher scores indicating higher levels of risk associated with alcohol consumption.

Age at onset. Age at the onset of alcohol consumption was measured using a single open-ended item ("How old were you when you first started drinking alcohol, not

including small sips or tastes?") used in previous research (e.g., Hingson, 2009; Hingson, Heeran, & Winter, 2006).

Personality. Items from Goldberg's International Personality Item Pool (IPIP; Goldberg et al., 2006) were used to measure conscientiousness and sensation-seeking. The sum of ten, 5-point response items, were used to quantify each trait and measured the degree to which each statement (e.g., "am always prepared") applied to the respondent (1 - very inaccurate, 5 - very accurate). Using the recommended cut-off Cronbach's alpha score of ≥ .7 to indicate acceptable internal consistency (e.g. Kline, 1999), the sensation-seeking scale was shown to have good reliability (α = .85) and the conscientiousness scale was shown to have slightly questionable reliability (α = .67). However, since this alpha did not deviate too far from the recommended cut-off of .7, the scale was retained in the subsequent analysis.

Religiosity. Religiosity was quantified using the sum of two, 5-point response items, designed for the purpose of this study. The first item measured strength of religion (1 - not at all religious, 5 - very religious), and the second measured frequency of service attendance (1 - never, 5 - 4+ times per week). Cronbach's alpha indicated good internal consistency (α = .80).

Alcohol-related motivations. Items from the Revised Drinking Motives Questionnaire (DMQ-R; Cooper, 1994) measured four areas of motivation to drink alcohol (social, coping, enhancement, and conformity). Each motivation was quantified using the sum of five, 5-point response items, which asked participants to indicate how frequently their drinking is motivated by each of the reasons (e.g., "to forget your worries"; 1 - almost never / never, 5 - almost always / always). All scales showed good internal consistency. Specifically, the social drinking motive scale had a Cronbach's alpha of .90, the coping drinking motive scale had an alpha of .83, the enhancement

drinking motive scale had an alpha of .84, and the conformity drinking motive scale had an alpha of .88.

Self-efficacy. Participants were asked to indicate how confident they felt in their ability to stay within government guidelines when they drank on a novel, 5-point response item (1 - very confident, 5 - very unconfident).

Alcohol-related expectancies. Thirty-eight items, developed and validated by Fromme et al. (1993), measured seven alcohol expectancies (sociability, tension reduction, liquid courage, sexuality, cognitive and behavioural impairment, risk and aggression, and self-perception). Participants were asked to indicate how much they agree with each statement, using a 4-point response item (e.g., "If I were under the influence from drinking alcohol, I would feel courageous"; 1 - disagree, 4 - agree). The sociability, cognitive and behavioural impairment, and risk and aggression expectancy scales were all shown to have good internal consistency (α = .81, .80, and .81, respectively). The liquid courage, sexuality, and self-perception scales all had acceptable reliability (α = .72, .72, and .71, respectively). The tension reduction expectancy scale had slightly questionable reliability (α = .68), but did not deviate too far from the recommended cut-off of .7. Consequently, the scale was retained in the subsequent analysis.

Prototype perceptions. Two 10-point response items, adapted from previous literature (e.g., Gibbons, Gerrard, & McCoy, 1995), were used to examine prototype favourability and prototype similarity. Participants were asked to think about the type of person who binge drinks (a man who drinks more than three pints or six shorts, or a woman who drinks more than two pints or four shorts, in a single session/evening), and indicate how favourable their impression is of that person (1 - very unfavourable, 10 -

very favourable), and how similar they are to that type of person (1 - not at all similar, 10 - very similar).

Social norms. Perceived subjective and descriptive norms were measured for family members (mother, father, and closest sibling in age) and peers (university friends and the typical student) using items designed for the purpose of this study. Subjective norms were measured using a 5-point response item for each family member (e.g., "In general, how much do you think your mother/female guardian approves of adult alcohol consumption?"; 1 - strongly disapproves, 5 - strongly approves), and a 4-point scale for peers (e.g., "Do you think your university friends approve of how much alcohol you consume?"; 1 - definitely no, 4 - definitely yes).

Descriptive norms for each family member were measured using a 7-point response item ("How would you define your mother/female guardian's drinking behaviour?"; 1 - non-drinker, 7 - problem drinker). Descriptive norms for peers were measured using four 5-point response items. The items assessed perceived frequency of alcohol consumption (1 - never, 5 - 4 or more times per week), and perceived quantity drank on a typical drinking day (1 - 1-2 units, 5 - ≥10 units) among university friends, and the typical student.

4.3.3. Procedure

Ethical approval was granted from the University of Sussex School of Life Sciences Research Governance Committee (Appendix S), during the first term of the academic year. First year undergraduate students were approached on campus or at the halls of residence, and given the opportunity to complete the questionnaire to be entered into two £25 prize draws. The researcher provided the participant with a questionnaire pack, which included an information sheet that gave a brief description of the research, and a copy of the questionnaire. Participants were provided with an addressed envelope

to be used within the University's postal system or the researcher arranged to collect the completed questionnaire at a convenient time.

4.3.4. Statistical Analysis

Correlation Analysis. Bivariate correlation analyses were conducted to examine the relationship between AUDIT scores, and the stable and modifiable determinants identified in previous literature.

Hierarchical Multiple Regression. Significant correlates of AUDIT scores, identified in the correlation analysis, were entered into a stepwise hierarchical multiple regression model. Correlates considered to be the most stable predictors were entered in the first steps, followed by modifiable predictors in the later steps. Normative beliefs were entered in the final step to determine whether these correlates were able to explain a significant amount of variance in AUDIT score after other correlates were accounted for. The model was trimmed by removing correlates that did not predict unique variance in the context of a multivariate model to provide a parsimonious model of the level of risk associated with alcohol consumption.

Exploratory Interaction Analysis. Hierarchical regression analyses were performed to explore the interactions between the correlates in the final model. Significant interactions were examined and added to the final parsimonious model.

4.4. Results

The mean AUDIT score indicates that there is a "hazardous level of risk" among this sample of 230 first-term UK undergraduates. Scores range between "low risk" and "possible dependence" within one standard deviation of the mean (see Table 1).

4.4.1. Correlates of Level of Risk Associated with Alcohol Consumption

Table 1 shows that age at onset, conscientiousness, religiosity, and self-efficacy

Table 1. Descriptive statistics and bivariate correlations with AUDIT score

	M	*SD*	*n*	AUDIT Score	
AUDIT Score	12.83	7.41	230	-	
Age at Onset	14.89	1.75	219	-.39	***
Conscientiousness	31.60	7.47	218	-.40	***
Sensation-Seeking	29.80	2.26	217	.47	***
Religiosity	3.22	1.68	220	-.20	**
Coping Motive	10.83	4.42	221	.41	***
Conformity Motive	8.25	3.98	224	.16	*
Social Motive	18.00	4.69	224	.48	***
Enhancement Motive	14.87	4.86	219	57	***
Self-Efficacy	3.07	1.18	220	-.54	***
Liquid Courage Expectancy	2.43	0.62	224	.30	***
Impairment Expectancy	2.57	0.56	222	.19	**
Risk and Aggression Expectancy	2.28	0.69	220	.38	***
Sociability Expectancy	3.13	0.56	220	.34	***
Self-Perception Expectancy	1.90	0.64	221	.15	*
Sexuality Expectancy	2.06	0.67	215	.29	***
Tension Reduction Expectancy	2.34	0.67	222	.08	
Prototype Favourability	5.50	2.38	224	.42	***
Prototype Similarity	5.14	3.00	224	.55	***
Mother Drinking Approval	3.13	0.90	223	.09	
Father Drinking Approval	3.26	0.98	216	.05	
Sibling Drinking Approval	3.64	0.91	206	.23	**
Uni Friend Drinking Approval	3.19	0.75	222	.13	
Student Drinking Approval	3.09	0.73	223	.19	**
Mother Drinking	2.68	1.33	219	.25	***
Father Drinking	3.23	1.52	217	.16	*
Sibling Drinking	3.17	1.55	202	.27	***
Uni Friend Drinking Frequency	3.21	0.77	223	.47	***
Uni Friend Drinking Quantity	2.67	1.09	219	.47	***
Student Drinking Frequency	3.30	0.63	223	.17	**
Student Drinking Quantity	2.74	0.95	219	.34	***

*$p < .05$; ** $p < .01$; *** $p < .001$

were all negatively and significantly correlated with AUDIT scores. Using Cohen's (1992, 1988) criteria to interpret effect sizes, where $r = .10$ is a small effect, $r = .30$ is a medium effect, and $r = .50$ is a large effect; these relationships were shown to have small to large effect sizes. The findings imply that earlier age of onset, low conscientiousness, low religiosity, and low self-efficacy to drink within government guidelines, are all associated with greater levels of risk associated with alcohol consumption. Self-efficacy was shown to have a particularly large effect, accounting for 29% of the variance in AUDIT score for this sample, compared to 16% (conscientiousness), 15% (age at onset), and 4% (religiosity).

The remaining variables were all positively correlated with AUDIT scores with varying effect sizes. For example, the sensation-seeking personality trait had a medium effect size; explaining 22% of the variance in risk level associated with alcohol consumption, and was found to be a stronger correlate of AUDIT score than conscientiousness (16%).

Social drinking motives were scored as the most common reason for drinking, followed by enhancement, coping, and conformity. However, the enhancement drinking motives were most strongly correlated with AUDIT scores, explaining 32% of the variance in risk level associated with alcohol consumption, compared to 23% (social), 17% (coping), and 3% (conformity). Drinking to enhance physical and emotional state is associated more strongly with level of risk than other drinking motives.

The expectation of becoming more sociable following the consumption of alcohol was rated highest among the seven alcohol-related expectancies, followed by cognitive and behavioural impairment, liquid courage, tension reduction, risk and aggression, sexuality and, self-perception. Expecting to behave in a more risky and aggressive manner after drinking was the expectancy most strongly associated with

AUDIT score, explaining 14% of the variance in the level of risk associated with alcohol consumption. Tension reduction was not significantly correlated with AUDIT scores, and the remaining five expectancies explained between 2% (self-perception) and 12% (sociability) of the variance.

The prototypical binge drinker was rated marginally more favourable than similar but prototype similarity was more strongly correlated with level of risk associated with alcohol consumption, explaining 30% of the variance in AUDIT scores compared to 18%. The degree to which participants felt that they were similar to a binge drinker is more predictive of their level of risk than how much they like or dislike such a person.

From the specified family members, participants felt that siblings approved of their alcohol consumption most, followed by their father, and finally, mother. Out of their peers, participants felt that university friends would approve more of the amount they drank compared to a typical student. From the subjective norm measures, only sibling, and a typical student's approval were significantly correlated with AUDIT score. These two variables could account for 5% and 4% of the variance in level of risk associated with alcohol consumption, respectively.

Participants rated their father's drinking as more problematic than their sibling and mother's drinking behaviour. The frequency and quantity of a typical student's alcohol consumption were rated marginally higher than university friends. All of the descriptive norm measures were significantly correlated with AUDIT score. However, the perceived frequency and quantity of university friends' alcohol consumption were the most predictive variables, both explaining 22% of the variance in level of risk compared to 12% (typical student drinking quantity), 7% (sibling's drinking), 6% (mother's drinking), and 3% (typical student drinking frequency and father's drinking).

4.4.2. Developing a Parsimonious Model of Level of Risk Associated with Alcohol Consumption

Significant correlates of AUDIT scores were entered into an eight-step hierarchical multiple regression model. This analysis identified a series of correlates, which, although predictive of AUDIT scores, did not predict unique variance in the context of a multivariate model. Beta coefficients for religiosity, conscientiousness, expectancy measures, coping drinking motives, conformity drinking motives, enhancement drinking motives, prototype perception measures, two subjective norm measures (sibling and typical student approval), and five descriptive norm measures (mother, father, and sibling's problem drinking, and typical student's drinking frequency and quantity) were not significant in the final equation.

A trimmed regression model, including only those variables with significant beta coefficients, is shown in Table 2. Six independent variables explained 58% of the variance in AUDIT scores. At the first step, age at onset was shown to explain 14% of the variance in level of risk associated with alcohol consumption ($F_{Change} = 32.99$, $p < .001$, $R^2_{Change} = .14$). The addition of sensation-seeking at step two, significantly improved the amount of variance explained ($F_{Change} = 38.51$, $p > .001$, $R^2_{Change} = .14$) to account for a further 14%. At the third step, the inclusion of social drinking motives significantly enhanced the model ($F_{Change} = 34.73$, $p < .001$, $R^2_{Change} = .11$), and explained an additional 11%. Self-efficacy produced a significant increment in the amount of variance explained ($F_{Change} = 38.27$, $p < .001$, $R^2_{Change} = .10$), accounting for another 10%. Finally, in the fifth step, the two university friend descriptive norm measures (drinking frequency and drinking quantity) were shown to significantly improve the fit of the model ($F_{Change} = 19.17$, $p < .001$, $R^2_{Change} = .09$), and explain 9% of the variance in AUDIT score after the other variables were controlled for.

Table 2. Trimmed hierarchical regression of AUDIT scores on hypothesised correlates.

Step	Variable(s)	*ß*		*ß*		*ß*		*ß*		*ß*		*ß*	
1.	Onset	-.38	***	-.31	***	-.30	***	-.29	***	-.17	**	-.15	**
2.	Sensation-Seeking			.38	***	.35	***	.23	***	.22	***	.23	***
3.	Social Motivation					.33	***	.26	***	.24	***	.25	***
4.	Self-Efficacy							-.35	***	-.29	***	-.29	***
5.	University Friends Freq.									.14	*	.17	**
	University Friends Quant.									.23	***	.20	***
6.	Onset x Self-Efficacy											.20	***
R^2		.14		.29		.39		.49		.58		.62	
ΔR^2		.14		.15		.10		.10		.09		.04	
Model *F*		32.99	***	38.91	***	42.00	***	47.12	***	43.72	***	43.77	***

* $p < .05$; ** $p < .01$; *** $p < .001$

When the variables were entered in the specified order, self-efficacy was found to explain the largest proportion of variance in AUDIT scores ($t(191) = -5.50$, $p < .001$), followed by social motivation ($t(191) = 4.83$, $p < .001$), how much university friends drink ($t(191) = 4.33$, $p < .001$), sensation-seeking personality trait ($t(191) = 4.25$, $p < .001$), age at onset ($t(191) = -3.28$, $p = .001$), and how frequently university friends drink ($t(191) = 2.51$, $p = .01$). These findings indicate that individuals with greater risk levels associated with their alcohol consumption, will have begun drinking at a young age, have a sensation-seeking personality, be motivated to drink for social reasons, have low confidence in their ability to stay within government guidelines, and perceive their university friends to frequently drink high levels of alcohol.

Interactions between these variables were examined. Variables were mean-centred, and a series of hierarchical regression analyses were conducted following the procedures described by Baron and Kenny (1986). Each pair of independent variables were entered in the first step followed by their interaction term. Out of the 15 possible interaction terms, five were found to have significant beta coefficients. Age at onset had significant interactions with sensation-seeking ($p = .04$) and self-efficacy ($p < .001$). Sensation-seeking also had significant interactions with university friend's frequency of drinking ($p = .01$), and university friend's quantity ($p = .02$). Finally, university friend's drinking frequency had a significant interaction with self-efficacy ($p < .001$).

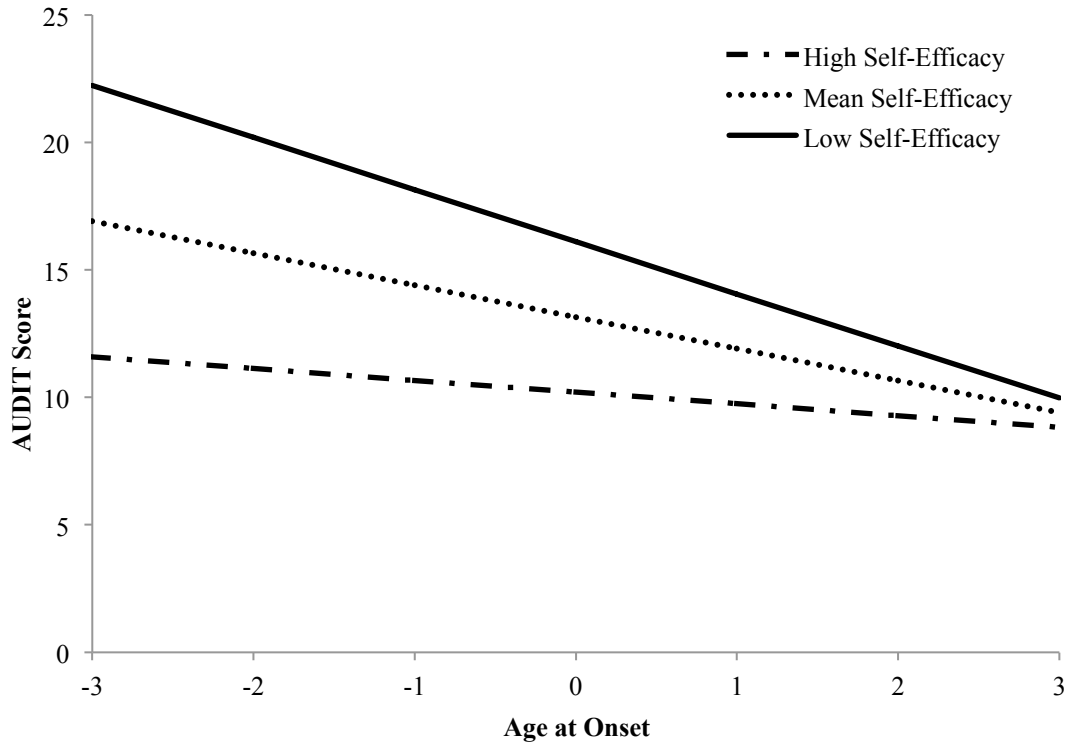
A second hierarchical regression analysis added these interaction terms to the six predictors in the trimmed regression model. Results showed that the addition of one interaction term significantly increased the variance explained by the main effects. The addition of the interaction between age at onset and self-efficacy ($F_{Change} = 19.15$, $p < .001$, $R^2_{Change} = .04$), accounted for a further 4% of the variance in AUDIT scores.

This interaction was plotted using the simple slopes technique (e.g., Preacher, Curran, & Bauer, 2006), using one standard deviation above and below the mean to distinguish between high (n = 38) and low scorers (n = 33) on self-efficacy. Figure 1 shows the relationship between age at onset and AUDIT scores at low, mean, and high levels of self-efficacy. Age at onset was significantly negatively correlated with AUDIT scores at low ($t(208) = 6.78$, $p < .001$), and mean levels of self-efficacy ($t(208) = 5.72$, $p < .001$). However, the association between AUDIT score and age at onset was not significant at high levels of self-efficacy ($t(208) = .75$, $p = .45$). This interaction suggests that level of risk associated with alcohol consumption among individuals who began drinking at an early age and have low or moderate levels of self-efficacy, may be particularly high.

4.5. Discussion

The House of Commons Health Committee (2010) has encouraged UK universities to reduce excessive student alcohol consumption. The results of this study confirm the applicability of determinants found to predict alcohol consumption in (mainly) US samples, with a sample of first-term UK undergraduates. The results also highlight a set of priority predictors. Out of 26 significant correlates, six constructs, and one interaction were found to explain 62% of the variance in AUDIT scores. The model indicates that undergraduate students with higher levels of risk associated with their alcohol consumption (1) will have begun drinking at an earlier age, (2) will be a sensation-seeker, (3) will drink for social reasons, (4) have low confidence in their ability to stay within government guidelines, (5) perceive their university friends to drink high quantities of alcohol, and (6) perceive their university friends to drink alcohol frequently. In addition, individuals with a combination of low self-efficacy and early age at onset may have particularly high levels of risk. Self-efficacy was found to

Figure 1. Significant interaction between Age at Onset and Self-Efficacy.



be a particularly important predictor for this sample followed closely by social motivations to drink. This parsimonious model characterises students with whom it may be most important to intervene, and identifies modifiable determinants that could be targeted in an intervention.

Supporting previous findings and the first hypothesis, age at onset, conscientiousness, religiosity, and self-efficacy negatively correlated with AUDIT scores, while sensation-seeking, drinking motives, alcohol-related expectancies, prototype perceptions, and social norms positively correlated. Correlations varied in strength, and four hypothesised correlations (i.e., expected tension reduction following consumption, mother's approval, father's approval and university friend's approval of drinking) failed to reach significance.

Age at onset, and the sensation-seeking personality trait were able to account for approximately half of the variance in AUDIT scores explained by the model. The addition of social drinking motives, self-efficacy, and university friend descriptive norm measures produced a significant increment in the amount of variance explained by the model, and accounted for the majority of the remaining variance. It is also notable that the two most useful predictors in the model were social drinking motives and self-efficacy. Stable constructs and potentially modifiable social cognitions were equally important in predicting AUDIT scores. Moreover, an interaction between the stable construct, age at onset, and the modifiable determinant, self-efficacy, made a significant contribution to the model. This further highlights the importance at taking an integrative approach when examining drinking correlates.

Self-efficacy has been associated with behaviour change and maintenance for various health behaviours (Strecher, McEvoy DeVellis, Becker, & Rosenstock, 1986). A recent review of self-efficacy interventions for addictive behaviours has shown that

self-efficacy is amenable to enhancement (Hyde, Hankins, Deale, & Marteau, 2008). Two studies included in this review showed that increasing levels of self-efficacy was associated with positive behaviour changes. However, no mediation analyses were reported. Undergraduate students' confidence in their ability to reduce alcohol consumption might be bolstered through practical suggestions such as alternating their alcoholic beverages with a soft drink or taking a specific amount of money with them on a night out. Trying such practical strategies when drinking may provide the student with a greater sense of control over their alcohol consumption, and with successful use of the strategy, experience enactive mastery, which may increase self-efficacy (e.g. Bandura, 1994).

Alcohol is commonly believed to facilitate social interactions. This is an important reason for drinking when meeting new people in the first year of university, and drinking for this reason was predictive of higher AUDIT scores in the results presented. However, excessive consumption leads to cognitive and behavioural impairments that are detrimental to the ability to socialise. The expectancy-challenge technique described by Darkes and Goldman (1993) could provide an effective way of confronting beliefs about the effects of alcohol and the motives that individual's have for drinking. Before playing a socially interactive game, participants are given an alcoholic beverage or placebo. Participants then identify individuals they think have consumed a drink containing alcohol. Identification errors are presented, and discussed in relation to the expectancies that the individuals have about the way alcohol effects behaviour. Findings from these studies are mixed. Some show reductions in positive expectancies of alcohol and drinking behaviour (Lau-Barraco & Dunn, 2008), others have shown the intervention to be more effective with women (Wiers & Kummeling,

2004), and some show a reduction in expectancies but not drinking behaviour (Musher-Eizenman & Kulick, 2003).

Age at onset and sensation-seeking are not amenable to change through campus-based interventions but can be used to identify those displaying riskier levels of drinking. The association found between earlier age at onset and level of risk associated with alcohol consumption found in this study also provides further support for previous research (e.g., Hingson et al., 2006), and the guidelines recently presented by the department of health, that suggest that the onset of alcohol consumption should be delayed until at least fifteen years of age (Donaldson, 2009). Previous research has shown that targeted interventions based on pre-screening school students high in sensation-seeking is cost effective and produces positive results (Conrod, Castellanos, & Mackie, 2008; Conrod, Stewart, Comeau, & Maclean, 2006). Consequently, university-based interventions could also prioritise those who began drinking at a younger age, and exhibit the sensation-seeking personality trait.

The perceived descriptive drinking norms for university friends significantly increased the amount of variance explained by the model after all other determinants were accounted for. However, beta coefficients indicated that social drinking motives and self-efficacy were the most important predictors of AUDIT score. Whilst these findings provide partial support for previous research in identifying normative beliefs as useful predictors of consumption behaviour, descriptive norms were not found to be the best predictors in this model. Moreover, subjective norm measures were not included in the model, as they did not explain a significant amount of the variance in AUDIT score.

The normative belief findings in this study also imply that, contrary to previous research (e.g., Borsari & Carey, 2001), subjective (approval) and descriptive (action) norms have distinctive roles in influencing alcohol consumption behaviour, and

subjective norms may not be as useful as assumed (e.g., Ajzen, 1991; 2001). This pattern of findings also emphasises how important it is to distinguish and clearly operationalize these separate constructs (Rimal & Real, 2003). Nonetheless, social norm interventions aiming to reduce the perceived drinking norms of college students in the US have shown promising results (Perkins, 2002). Campus-based interventions targeting drinking norms in groups of university friends warrant further investigation in the UK.

Interestingly, the perceived drinking behaviour of university friends was more predictive of AUDIT score than a typical student or family member's drinking. This provides partial support for the literature relating to social distance and normative beliefs (e.g., Yanovitsky, Stewart, & Lederman, 2006). Differences between one's own drinking behaviour and the perception of other's drinking behaviour are found to increase with social distance. Yet the relationship between one's own drinking behaviour and other's drinking behaviour decrease with social difference. These findings highlight the challenge of identifying optimal referents for use in social norm interventions; i.e., a reference group that will induce large enough self-other differences (SODs) to create cognitive dissonance, yet be influential enough to induce behavioural change (see also; Lewis & Neighbors, 2006).

Some limitations of the present study need to be considered. First, although the findings reported here are based on a fairly large sample, a further multi-campus study is required to test whether this sample is representative of first year UK university students more generally. The conscientiousness and tension reduction expectancy scales were shown to have slightly questionable internal consistency. As a result, the findings relating to these scales should be treated with caution. However, neither measure was included in the final regression model. This study reports correlations, which means that

inferences about causality cannot be drawn. Experimental studies testing interventions designed to change the modifiable cognitions identified by this study are needed to test how useful the model is as a guide to intervention.

One approach that should be considered among this population might be the use of computer-delivered interventions (CDIs), which have been shown to be a cost-effective approach (McCrone et al., 2004; Ownby, Waldrop-Valverde, Jacobs, Acevedo, & Caballero, 2013) and preferred among students when compared to face-to-face therapeutic intervention (Kypri, Saunders, & Gallagher, 2003). Moreover, computers and the Internet have been used previously to deliver alcohol-related interventions that target specific modifiable determinants, such as normative beliefs (e.g., Neighbors, Larimer & Lewis, 2004), and a variety of determinants within one programme (e.g., Barnett, Murphy, Colby, & Monti, 2007). CDIs can also provide tailored content according to specific risk traits pre-determined by a screening process (Lustria, Cortese, Noar, & Glueckauf, 2009).

The model developed here focuses on psychological correlates of alcohol consumption among students and highlights motivational factors, which may be amenable to change through campus-based interventions. This does not mean that reduction of students' drinking depends solely on motivational interventions. Structural changes in accessibility and price are also likely to be important (Chaloupka & Wechsler, 1996; Wechsler, Kuo, Lee, & Dowdall, 2000; Weitzman, Nelson, & Wechsler, 2003). However, these determinants are most effectively targeted by national policy and legislative changes. Such population-level changes are likely to be associated with smaller effects for the individual but greater benefits for the population when compared to an intervention based on this model for level of risk associated with alcohol consumption among students (Rose, 1985).

In conclusion, a range of correlates of student drinking highlighted in mainly US based literature have been explored. The strongest correlates of high AUDIT scores among a sample of UK university students in their first term have been identified. The results suggest that campus-based interventions should prioritise students who have begun drinking earlier and have high sensation-seeking tendencies. Interventions could also usefully focus on enhancing safe drinking self-efficacy, challenging the belief that alcohol facilitates socialisation, and shifting perceptions among friendship groups regarding the amount and frequency with which others drink.

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Chapter 5

Computer-delivered alcohol interventions for students: Do they work? How do we know?

5.1. Abstract

Computer-delivered interventions (CDIs) may offer universities and colleges with a practical and cost-effective option for disseminating intervention material among their student population. Previously published CDI reviews have intimated that various control conditions and alcohol-related outcomes have been used to evaluate efficacy. However, none have provided an in depth analysis of the range or influence of these factors on effect size. This meta-analysis examined the overall effectiveness of CDIs and provided separate analyses across control conditions and outcomes utilised. Exploratory analyses were also conducted to examine CDI effectiveness for potential moderators and to identify characteristics associated with the largest intervention effects. Between-group effect sizes were calculated for alcohol-related outcomes reported by 68 separate CDI evaluations within 54 studies published before May 2013. While results show CDIs to have a low overall mean effect size, further analyses revealed that effects were larger for primary outcomes (i.e., alcohol consumption measures) compared to secondary outcomes (i.e., alcohol-related problems and alcohol-related risk) and varied according to the control condition and outcomes used. Interventions that targeted heavy/binge drinking students, were conducted in the US, and incorporated personalised normative feedback were associated with the largest effects. In addition to practical implications, these findings are discussed in terms of the utility of different control groups and the need for a "gold-standard" assessment of CDI efficacy.

5.2. Introduction

The short- and long-term negative effects of excessive alcohol consumption on physical and mental health are well documented (e.g., NHS, 2012). University students regularly report drinking excessively (e.g., Gill, 2002; Hingson, 2010; Karam, Kypri, & Salamoun, 2007) and have been shown to drink more hazardously than their non-student peers (Dawson, Grant, Stinson, & Chou, 2004; Kypri, Cronin, & Wright, 2005). Although alcohol consumption and alcohol-related problems tend to reduce from the first to the final year of undergraduate courses (Bewick et al., 2008a), higher levels of alcohol consumption during the first year increase the likelihood of high consumption in subsequent years (Bewick et al., 2008a), and binge drinking and alcohol abuse a decade following graduation (Jennison, 2004).

This is an international problem. Legal repercussions of the minimum alcohol drinking and purchasing age of 21 years old has motivated US universities to take action. As a result, the student intervention evaluation literature is dominated by US studies (e.g., Lenk, Erickson, Nelson, Winters, & Toomey, 2012; U.S. Department of Education, 2008). However, student alcohol-related problems have been reported in Australasia, Europe, and South America (e.g., Dantzer, Wardle, Fuller, Pampalone & Steptoe, 2006; Karam et al., 2007) and universities have been advised to intervene. For example, the House of Commons Health Committee (2010) in the UK has recommended that "universities take a much more active role in discouraging irresponsible drinking amongst students" (p. 21).

Many behaviour change interventions to reduce alcohol consumption and/or promote responsible drinking among students have been evaluated and these studies have been synthesised by reviewers (e.g., Larimer, Cronce, Lee, & Kilmer, 2004; Moreira, Smith, & Foxcroft, 2009; Riper et al., 2009; Walters & Neighbors, 2005;

White, 2006). Unfortunately, such evaluations tend to show considerable heterogeneity in terms of target group, intervention content, the mode or format of intervention delivery, and the intensity and duration of interventions, making it difficult to draw firm conclusions about what works for whom.

Technological advances have facilitated new delivery modes. The use of computers and the Internet to disseminate health interventions has a number of advantages (Rhodes, Bowie, & Hergenrather, 2003; Ritterband et al., 2003; Taylor & Luce, 2003). First, at-risk drinking and treatment seeking have been shown to be associated with high levels of perceived stigma (e.g., Fortney et al., 2004; Corrigan et al., 2005). Computer and Internet programs can provide a low-stigma approach by ensuring anonymity to participants. Second, participants can experience greater flexibility by completing tasks or reading materials at their own convenience and researchers still have the flexibility to provide interactive and tailored material (e.g., Lustria, Cortese, Noar, & Glueckauf, 2009; Portnoy, Scott-Sheldon, Johnson, & Carey, 2008). Third, computer and Internet delivered interventions have to ability to reach large audiences.

Evaluations of computer-delivered interventions (CDIs) for anxiety and depression (McCrone et al., 2004) and HIV medication adherence (Ownby, Waldrop-Valverde, Jacobs, Acevedo, & Caballero, 2013) also indicate that this mode of delivery is cost-effective when compared to face-to-face techniques, and as such, may be a practical solution for widespread use in higher education institutions. Moreover, CDIs have been shown to be preferred among students when compared to practitioner-delivered interventions (Kypri, Saunders, & Gallagher, 2003).

To date, a number of published reviews include alcohol-related CDIs that target students within a broader scope of delivery modes (e.g., face-to-face, print, and mail).

For instance, CDIs have been included among a sample of various types of intervention that aim to reduce undergraduate alcohol consumption (Fager & Melnyk, 2004), brief interventions that last one or two sessions (Larimer et al., 2004), and interventions that provide feedback regarding one's own drinking in comparison with peers normative behaviour (Lewis & Neighbors, 2006; Moreira et al., 2009; Riper et al., 2009; Walters & Neighbors, 2005; White, 2006). CDIs have also been included among reviews of event-specific prevention (i.e., known windows of risk such as 21st birthday celebrations and spring break in the US; Neighbors et al., 2007), individual-level interventions as an alternative to group intervention (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Larimer & Cronce, 2007), and alongside other no contact interventions as an alternative to person-delivered interventions (Zisserson, Palfai, & Saitz, 2007).

CDIs targeted at students are also included in reviews that examine intervention effectiveness within the general population (Bewick et al., 2008b; Khadjesari, Murray, Hewitt, Hartley, & Godfrey, 2011; Portnoy et al., 2008; Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010; White et al., 2010) and those that target all young people (Tait & Christensen, 2010). Furthermore, alcohol-related CDIs have been combined with interventions targeting other health behaviour patterns (Portnoy et al., 2008; Rooke et al., 2010; Tait & Christensen, 2010) and with other innovative intervention approaches (Kypri, Sitharthan, Cunningham, Kavanagh, & Dean, 2005). While all of these reviews are informative, none address the question of whether CDIs are effective in reducing student alcohol consumption.

Three reviews have examined the effectiveness of CDIs targeting student populations (Carey, Scott-Sheldon, Elliott, Bolles, & Carey, 2009; Carey, Scott-Sheldon, Elliot, Garey, & Carey, 2012; Elliott, Carey, & Bolles, 2008). Elliott et al. (2008) provides a narrative review of 17 randomised controlled trials (RCTs) published

before 2008 and although they did not examine average effect sizes, these authors concluded that CDIs are "usually more effective than no treatment, and approximately equivalent to alternative intervention approaches" (p. 1001). Carey et al. (2009) presented a meta-analysis of 35 evaluation studies published between 2000 and 2008 that examined average effect sizes for short-term (≤5 weeks) and long-term follow-ups (≥6 weeks). Results showed that CDIs were associated with significant short-term reductions in quantity over a specified interval/drinking day (d_+ = .10; 95% CI [.01, .20]) and maximum quantity consumed (d_+ = .16; 95% CI [.01, .31]), and long-term reductions in quantity of alcohol consumed (d_+ = .15; 95% CI [.05, .25]), frequency of drinking days (d_+ = .16; 95% CI [.03, .29]), and alcohol-related problems (d_+ = .16; 95% CI [.06, .25]). Carey et al. (2012) present a meta-analysis of 48 studies (including 22 face-to-face versus assessment only studies and 26 CDI versus assessment only studies) published between 1998 and 2010 that examined the effect sizes for short-term (≤13 weeks), intermediate-term (14-26 weeks), and long-term (≥27 weeks) follow-ups. Results showed that CDIs were associated with significant short-term reductions in quantity per week/month (d_+ = .14; 95% CI [.03, .24]), frequency of heavy drinking (d_+ = .13; 95% CI [.02, .24]), and peak blood alcohol content (BAC; d_+ = .29; 95% CI [.12, .47]), but no significant effects for intermediate- and long-term follow-ups.

Of note, the Carey et al. (2009, 2012) meta-analyses are inconsistent regarding their definition of short-term and long-term follow-up periods. In the 2009 meta-analysis, Carey and colleagues consider a short-term follow-up to be 5 weeks or less, whereas a follow-up of 13 weeks or less is considered as a short-term follow-up in the 2012 meta-analysis. Follow-up durations of 6 or more weeks are considered to be long-term in the 2009 paper, while follow-ups of 27 weeks or more are considered as long-

term in the 2012 paper. Such inconsistencies make it difficult to compare the findings from reviews.

Carey et al. (2012) only included studies comparing CDI to assessment-only conditions (i.e., intervention group versus a control group that received identical alcohol assessment measures but no intervention). Carey et al. (2009) included a variety of control groups. In a supplementary analysis, they categorised control groups into alcohol relevant and non-relevant content controls. Within the alcohol relevant group, they included interventions with the same content as the CDI but alternative delivery (e.g., print) and alcohol-related education. Within the non-relevant category, they included assessment-only controls, and alternative interventions or educational material that were not related to alcohol. Results showed that when compared to alcohol-relevant content, CDIs only show a significant long-term effect on alcohol-related problems (d_+ = .17; 95% CI [.05, .30]), whereas, when compared to non-relevant content, CDIs show significant effects on a number of alcohol-related outcomes ranging from d_+ = .15 (95% CI [.01, .28]) to d_+ = .28 (95% CI [.10, .46]). These findings are important because they emphasise that the control group used in the study design influences the effect size observed for CDIs (cf. de Bruin et al., 2010). However, these results do not clarify whether CDIs compared to no-intervention (assessment-only) control groups are likely to appear more or less effective than CDIs compared to active, non-relevant controls.

These two meta-analyses also demonstrate the variety of different alcohol-related outcomes currently measured by intervention studies and that effect sizes vary according to outcome. The Carey et al.'s (2009, 2012) meta-analyses identify a total of six categories of outcome measures, whereas Elliot et al. (2008) identify sixteen categories. Therefore, there may be more scope to explore the impact on CDI effectiveness of a wider range of alcohol consumption measures.

The increases in Internet accessibility and usage (e.g., Office for National Statistics, 2011; United States Census Bureau, 2010), and information seeking and self-diagnosis using health-related websites (Department of Health, 2010), have been reflected in increasing demand for web-based alcohol-related health information, and the increase in development and evaluation of CDIs since Elliott et al. (2008) and Carey et al. (2009) published their reviews. A further 30 CDI versus assessment-only evaluations have been published since Carey et al.'s (2009) meta-analysis and 12 since Carey et al.'s (2012) meta-analysis. A further 14 CDI versus other control conditions (including alcohol-relevant and non-relevant content controls) have been published since Carey et al.'s (2009) meta-analysis.

5.2.1. The Present Study

This systematic meta-analytic review examined the effectiveness of CDIs designed to reduce alcohol consumption and/or alcohol-related problems among undergraduate students. The review had four aims. The first was to estimate the overall effectiveness of CDIs among undergraduate students. Second, to characterise the range of control groups used in CDI evaluations and ascertain whether effect sizes differ according to control group selection. Third, to describe the range of alcohol-related outcome measures used in CDI student evaluations and establish whether effect sizes vary according to outcome measure used. Finally, to identify characteristics associated with the largest intervention effects through exploratory analyses of potential moderators of intervention efficacy, such as country, year of study, drinking status, and intervention type.

5.3. Method

5.3.1. Systematic Literature Search

Studies published in English up to and including May 2013 were identified by (1) performing systematic electronic database searches of PubMed®, PsycINFO®, PsycARTICLES®, ERIC, MEDLINE®, ProQuest Dissertations and Theses, the Cochrane library and Scopus, (2) manually examining the reference list of previously published literature review/meta-analyses that include CDIs, and (3) manually examining the reference list of papers retrieved.

During the systematic search of electronic databases, a Boolean search strategy using the operators "AND" and "OR", with the operator "*" to include multiple variations of the word, was employed to identify studies that used a combination of terms that denoted the use of a computer/electronic device (*computer** OR *electronic* OR *online* OR *internet* OR *web** OR *intranet* OR *software* OR *e health* OR *ehealth* OR *e intervention* OR *eintervention*), to examine/target alcohol use (*alcohol* OR *drink** OR *binge**), within a university setting (*student** OR *undergraduate** OR *freshmen* OR *college** OR *universit** OR *campus**), using an intervention/randomised controlled design (*intervention** OR *reduc** OR *prevention* OR *rct** OR *randomi** *control** *trial** OR *trial**).

5.3.2. Inclusion/Exclusion Criteria

Eligible articles examined the effectiveness of an individual-level computer-delivered intervention that aimed to reduce alcohol consumption and/or alcohol-related problems among a student population relative to at least one control condition. Computer delivery includes the use of Internet or CD-ROM based interventions, delivered either on-site (e.g., in a laboratory setting), or off-site (e.g., the participant's own home). Studies were excluded if the CDI included any face-to-face therapeutic

guidance or discussion, or the intervention content related to other health or drug-taking behaviour, such as exercise or tobacco use. Overall, studies were included if: -

(1) an alcohol-only CDI was assessed,

(2) the CDI was compared to an assessment only or active control group that were either alcohol-related (e.g., alcohol information leaflet), or not alcohol-related (e.g., general health education) and deemed less intensive than the CDI,

(3) pre-post or post-test only comparisons on continuous alcohol consumption or alcohol-related problems outcome measures were reported,

(4) the participants were college or university students[1], including subgroups of students, such as first year undergraduates, mandated, athletic, and heavy/risky drinkers, and

(5) the study was reported in a journal article or dissertation published in the English language before May 2013.

5.3.3. Search Results

Figure 1 shows the process of study retrieval in a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram (Moher, Liberati, Tetzlaff, & Altman, 2009). Of the initial 2230 records identified from the database search and 5 records identified from the manual search of relevant reference lists, 1135 abstracts were screened, and 130 full-text articles were retrieved. Fifty-four articles matched the eligibility criteria and provided the necessary data to calculate effect sizes for the meta-analyses. The 54 articles provided data evaluating 68 computer-delivered interventions.

[1] In the United States, students can complete a bachelor's undergraduate degree at a University or College. Both types of institution follow after high school, when a student is 17 or 18 years old. In Europe, College tends to refer to an institution attended prior to completing a bachelor's degree. As such, college-based interventions from the US were included in the analysis.

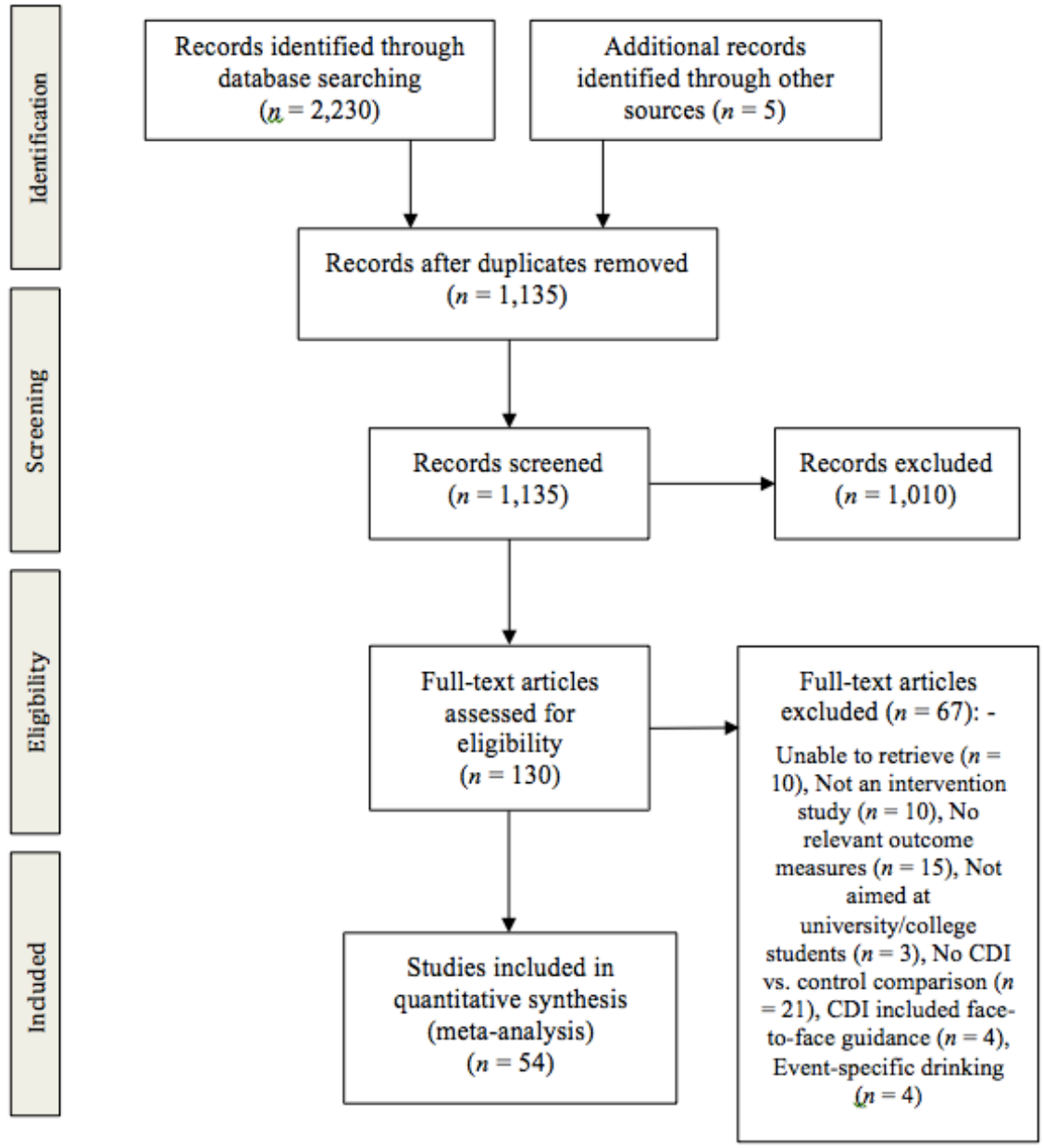

Figure 1. PRISMA flow diagram of study selection.

5.3.4. Data and Effect Size Extraction

Studies were coded according to study information (e.g., publication year and country of origin), target group details (e.g., first year undergraduates, intercollegiate athletes, binge drinkers), intervention and control group contents (e.g., duration, type, number of sessions), design (e.g., RCT or quasi-experimental), and outcomes (e.g., measures used, follow-up).

Multiple effect sizes were calculated when a study reported multiple alcohol-related outcomes, multiple interventions, multiple control groups, and when outcomes were provided for independent subgroups, such as males and females. In a few CDI evaluations ($k = 3$), multiple alcohol-related outcomes deemed to measure the same aspect of alcohol-related behaviour were provided. In such instances, corresponding effect sizes were averaged. For example, Hedman (2007) reported the frequency of binge drinking in the previous 14 days and the frequency of binge drinking in the previous 30 days which are both considered to measure binge drinking frequency, and Wall (2005) reports negative physical consequences, negative memory or hangover consequences, and negative sexual consequences, which are all considered to measure negative consequences. Effect sizes for independent subgroups and multiple intervention/control groups were treated as a separate study (Lipsey & Wilson, 2001). When multiple follow-ups were used, effects sizes were calculated for the assessment nearest to the median follow-up time of 8 weeks. The median follow-up of 8 weeks was considered to be more representative than the average follow-up time (12 weeks) as the majority of intervention evaluations ($k = 41$) took place between 4 and 12 weeks following the intervention.

Adjusted between group effect sizes were calculated as the standardized mean difference (*SMD*) between the intervention and control group at follow-up (i.e., M_{control}

– $M_{intervention}$ / SD_{pooled}) minus the *SMD* at baseline (wherever possible) as suggested in Wilson and Lipsey (2007). Without adjusting for baseline differences, the effect size attributed to the efficacy of the intervention may be over- or under-estimated and as such, would not reflect the true effectiveness of the CDI. In instances where means and standard deviations were not available, alternative computations were used (e.g., using *t*-values and sample sizes; Lipsey & Wilson, 2001) or estimates of the mean and standard deviation were made (e.g., from the median and confidence intervals; Hozo, Djulbegovic & Hozo, 2005). Positive effect sizes indicate that the intervention is associated with reductions in alcohol-related behaviour relative to the control.

5.3.5. Statistical Analysis

A series of meta-analyses using Schwarzer's (1988) programme "Meta" were conducted using a random effects model (Hedges & Olkin, 1985) due to the heterogeneity of the studies included in the analysis. This programme converts *SMD* effect sizes (as described above) into Hedge and Olkin's (1985) unbiased effect size estimate *d* ((1 - (3 / (4 x *N* - 9))) x *SMD*) before providing a weighted mean effect size (δ) and 95% confidence intervals. Using Cohen's (1988) guidelines, a mean effect size above .20 is considered small, above .50 is medium and above .80 is large. The significance of the effect size is tested using the normal distribution *Z* and the heterogeneity of the effect size is evaluated using coefficient *Q*.

5.4. Results

5.4.1. Study Characteristics

Table 1 provides details of the 54 published studies and dissertations that report the 68 CDI evaluations included in the meta-analysis and Table 2 summarises the characteristics of these evaluations. Details provided in Table 1 include the reference

and type of report (i.e., published study or dissertation), the number and location (country) of the university/universities used, the target group (i.e., the type of student that was targeted and the eligibility criteria), the demographic characteristics of the participants, details of the CDI and control condition used, the alcohol-related outcome measures used to assess the efficacy of the intervention and the significant findings of the study.

In many instances, a published study/dissertation reported data on more than one CDI versus control evaluation. For example, Hagger, Lonsdale, and Chatzisarantis (2012) used a four-arm study design with three groups assigned to an intervention and one group assigned to an assessment-only control condition. One intervention group was assigned to a mental simulation intervention where participants were asked to visualise themselves achieving their goal of keeping alcohol intake within 'safe' limits, and provide an explanation of how they think they would feel. The second intervention group were asked to complete an implementation task where participants were asked to provide an '*if…then…'* plan to help them achieve the intention of keeping their alcohol intake within 'safe' limits (e.g., '*If* I am in a bar/pub drinking with my friends and I am likely to drink over the daily safe limits for alcohol, *then* I will opt for a soft drink instead of an alcoholic drink to keep within the recommended safe limits'). The third intervention group were asked to complete a combination of both interventions. This yields data for three CDI versus assessment-only evaluations.

In some instances, more than one published study/dissertation reported data on the same CDI versus control evaluation. For example, the dissertation by Lewis (2005), and the published study by Lewis and Neighbours (2007), both report data from the same intervention (gender and student specific personalised normative feedback or student specific personalised normative feedback) versus assessment-only evaluations.

Table 1. Characteristics of the 54 published studies/dissertations included in the meta-analysis

Reference	Site(s)[a]	Target Group	Demographics	Conditions[b]	Outcome Measures	Significant Findings
Bendtsen et al. (2012) *Published Article*	1 *SE*	First year undergraduate students *All eligible*	Female (53%); 18-20yrs (46%), 21-25yrs (41%), 26+yrs (13%); 1st year (100%)	CDI (*N* = 697) Student Specific PNF *Immediate feedback* Control 1 (*N* = 737) AO Control 2 (*N* = 902) DAO	(1) Quantity, (2) Frequency of binge drinking, (3) Problem drinking *8wk follow-up*	Relative change in quantity CDI risky drinkers reported greater pre-post reductions than control 1 risky drinkers (not significant in the intention to treat analysis)
Bewick et al. (2008) *Published Article*	1 *UK*	Students *All eligible*	Female (69%); *M* = 21.29yrs (*SD* = 3.68yrs)	CDI (*N* = 234) Student Specific PNF *Continual access (12wks)* Control (*N* = 272) AO	(1) Quantity, (2) Average quantity per drinking day, (3) Problem drinking *3mth follow-up*	Average quantity per drinking day CDI reported greater pre-post reductions than controls
Bewick et al. (2010) *Published Article*	4 *UK*	Students *Consume alcohol ≥ once every 6mths*	Female (73%); *M* = 21.45yrs (*SD* = 5.19yrs); Undergraduate (95%); White (92%)	CDI 1 (*N* = 334) Student Specific PNF *Continual access (7wks)* CDI 2 (*N* = 424)† Student Specific PNF *Delayed continual access (7wks)* Control (N = 354) AO	(1) Quantity, (2) Average quantity per drinking day *8wk, 16wk† & 24wk† follow-ups*	Quantity All participants showed pre-post reductions Average quantity per drinking day CDI 2 and controls showed significant pre-post reductions

Bingham et al. (2010); Bingham et al. (2011)* *Published Articles*	1 *US*	First year undergraduate students *18-20yrs old, identify as a US citizen or permanent resident, never been married, live in a dormitory, do not live in learning communities or substance-free dorms*	Female (59%); *M* = 18.1yrs (*SD* = 0.34yrs); 1st year (100%); White (80%), Asian (11%), Hispanic (4%), African American (2%), Other (3%)	CDI (*N* = 616) Multicomponent, tailored program (M-PASS) *4 x 10-15min sessions* Control (*N* = 521) AO	(1) Quantity, (2) Average quantity per drinking day, (3) Frequency of binge drinking, (4) Negative consequences *Post-test† & 10wk follow-ups*	Quantity At post-test, CDI high-risk females < controls Average quantity per drinking day At post-test, CDI low-risk females < controls Frequency of binge drinking At post-test & 10wks, CDI high-risk males < controls. At 10wks, high-risk females < controls. Negative consequences At 10wks, high-risk females < controls.
Braitman (2012) *Dissertation*	1 *US*	Undergraduate students *18-24yrs old, consume ≥ 4 alcoholic drinks in the previous 2wks*	Female (65%); 18-24yrs; 1st year (37%), 2nd year (29%), 3rd year (24%), 4th year (9%), Other (1%); White (60%), African American or Black (22%), Asian or Pacific Islander (6%), Latino or Latina (5%), Native American (1%),	CDI 1 (*N* = 172) Multicomponent program (Alc101+) plus booster email *1 x 60min session + 1 x email* CDI 2 (*N* = 181) Multicomponent program (Alc101+) *1 x 60min session*	(1) Quantity, (2) Peak quantity, (3) Frequency of drinking days, (4) Peak BAC, (5) Frequency of binge drinking, (6) Frequency of intoxication, (7) Negative consequences	Frequency of drinking days, Frequency of binge drinking, Peak quantity & Peak BAC Growth to 4wks, CDI 1 < controls

			Other (6%)	<u>Control (*N* = 39)</u> Multicomponent HIV program *1 x 60min session* AC-NR	*2wk*[†] *& 4wk follow-ups*	
Bryant (2009) *Dissertation*	1 *US*	Undergraduate psychology students *All eligible*	Female (76%); *M* = 18.7yrs; Caucasian (82%), African American (9%), Bi-racial (6%), Asian (3%)	<u>CDI (*N* = 101)</u> Multicomponent email (BASICS) *1 x email* <u>Control (*N* = 90)</u> Alcohol facts email *1 x email* AC-R	(1) Quantity, (2) Frequency of drinking days, (3) Frequency of binge drinking, (4) Frequency of intoxication, (5) Frequency of light-headedness, (6) Problem drinking, (7) Negative consequences *6wk follow-up*	<u>Quantity & Frequency of intoxication</u> CDI reported pre-post reductions, control reported increases
Butler & Correia (2009) *Published Article*	1 *US*	Undergraduate students *Report ≥ 2 binge drinking episodes and ≥ 2 alcohol-related problems in the previous 1mth*	<u>CDI</u> Female (63%); *M* = 20.6yrs (*SE* = 1.48yrs); White (86%) <u>Control</u> Female (65%); *M* = 20.38yrs (*SE* = 1.49yrs); White (96%)	<u>CDI (*N* = 30)</u> Gender & student specific PNF *1 x 11min session* <u>Control (*N* = 26)</u> AO	(1) Quantity, (2) Frequency of drinking days, (3) Frequency of binge drinking, (4) Negative consequences *1mth follow-up*	<u>Quantity, Frequency of drinking days, Frequency of binge drinking & Negative consequences</u> At 1mth, CDI < controls

Carey et al. (2011) *Published Article*	1 *US*	Mandated students *No previous alcohol violations, the offense was not severe enough to warrant referral to Judicial Affairs, reported consuming alcohol in the 1mth before the sanctioned event*	Female (46%); *M* = 19yrs (*SD* = 0.71yrs); 1st year (67%), 2nd year (29%); White (85%)	<u>CDI 1 (*N* = 172)</u> Multicomponent program (Alc101+) *1 x 60min session* <u>CDI 2 (*N* = 167)</u> Multicomponent program (AlcEdu) *Continual access* <u>Control (*N* = 174)</u> AO	(1) Quantity, (2) Average quantity per drinking day, (3) Peak quantity, (4) Average BAC, (5) Peak BAC, (6) Frequency of binge drinking, (7) Negative consequences *1mth follow-up*	<u>Overall consumption (Latent)</u> All females reported pre-post reductions. CDI 1 & CDI 2 males reported pre-post reductions, controls reported pre-post increases <u>Negative consequences</u> CDI 2 & control females reported pre-post reductions
Chiauzzi et al. (2005) *Published Article*	5 *US*	Students *Report ≥ 1 binge drinking episode in the previous 1wk*	Female (54%); *M* = 19.9yrs (*SD* = 1.6yrs); 1st year (34%), 2nd year (33%), 3rd year (19%), 4th/5th year (14%); White (73%), Asian (11%), Black (3%), Latino/Hispanic (8%), Other (5%)	<u>CDI (*N* = 131)</u> Multicomponent program (MSB) *4 x 20min sessions* <u>Control (*N* = 134)</u> Educational website (Alc&You) *4 x 20min sessions* AC-R	(1) Quantity, (2) Average quantity per drinking day, (3) Peak quantity, (4) Quantity during special occasions, (5) Peak quantity during special occasions, (6) Frequency of drinking days, (7) Frequency of binge drinking, (8) Composite alcohol consumption measure	<u>Quantity, Average quantity per drinking day, Frequency of drinking days & Frequency of binge drinking</u> All participants reported pre-post reductions <u>Peak quantity</u> At 1mth, CDI greater pre-post reductions than controls <u>Quantity during special occasions, Peak quantity during special occasions</u>

					1mth[†] *& 3mth follow-up*	Female CDI < female controls Composite alcohol consumption measure All participants showed pre-post increases
Croom et al. (2009) *Published Article*	1 *US*	Incoming first year undergraduate students *All eligible*	Female (49%); 17yrs (19%), 18yrs (75%), 19yrs+ (6%); 1st year (100%); White (63%), Asian (25%), Hispanic (6%), African American (4%), Other (2%)	CDI (*N* = 1608) Multicomponent program (AlcEdu) *Continual access* Control (*N* = 1608) AO	(1) Quantity *4-4.5wk follow-up*	*NS*
Cunningham et al. (2012) *Published Article*	1 *US*	Students *Scored ≥ 4 on the AUDIT-C*	Female (48%); *M* = 22.6yrs (*SD* = 3.9yrs)	CDI (*N* = 211) Gender, age & student specific PNF (CYD-U) *Immediate feedback* Control (*N* = 214) AO	(1) Composite alcohol consumption measure *6wk follow-up*	*NS*
Curtis (2005) *Dissertation*	1 *CA*	Undergraduate students *17-25yrs old, able to communicate in English, not receiving treatment for alcoholism and/or*	Female (60%); *M* = 20.5yrs (*SD* = 1.9yrs); 1st year (24%), 2nd year (25%), 3rd year (26%), 4th year (25%)	CDI 1 (*N* = 60) Gender & student specific attitudinal PNF *Immediate feedback* CDI 2 (*N* = 53) Gender & student specific behavioural	(1) Quantity, (2) Peak quantity, (3) Frequency of drinking days, (4) Frequency of binge drinking, (5) Negative consequences	*NS*

		other drug addiction		PNF *Immediate feedback* Control (*N* = 72) AO	*6wk Follow-up*	
Doumas & Andersen (2009) *Published Article*	1 *US*	First year undergraduate students *Enrolled on a 16wk seminar, ≥18yrs old*	Female (41%); 18-54yrs old (*M* = 21.99yrs, *SD* = 7.69yrs); 1st year (100%); Caucasian (79%), Hispanic (13%), Other (8%)	CDI (*N* = 28) Student specific PNF (e-CHUG) *Immediate feedback* Control (*N* = 52) AO	(1) Quantity, (2) Frequency of intoxication, (3) Negative consequences *3mth follow-up*	Quantity, Frequency of intoxication & Negative consequences CDI high-risk drinkers reported greater pre-post reductions than control high-risk drinkers
Doumas & Haustveit (2008) *Published Article*	1 *US*	First year undergraduate intercollegiate athletes *Enrolled on a freshmen seminar*	Female (42%); 18-20yrs old (*M* = 18.10yrs, *SD* = 0.61yrs); 1st year (100%); Caucasian (54%), African American (27%), Asian-American (6%), Hispanic (2%), Other (11%)	CDI (*N* = 28) National peer specific PNF (CYD) *Immediate feedback (15mins)* Control (*N* = 24) Alcohol education website *1 x 15min session* AC-R	(1) Quantity, (2) Peak quantity, (3) Frequency of intoxication *6wk & 3mth*† *follow-up*	Quantity, Peak quantity & Frequency of intoxication CDI high-risk drinkers reported greater pre-post reductions than control high-risk drinkers

Doumas et al. (2010) *Published Article*	1 *US*	First year undergraduate intercollegiate athletes *Enrolled on a freshmen seminar*	Female (57%); 18-20yrs old (*M* = 18.08yrs, *SD* = 0.48yrs); 1st year (100%); Caucasian (70%), African-American (16%), Asian-American (2%), Hispanic (5%), Other (7%)	CDI (*N* = 62) Student specific PNF (e-CHUG) *Immediate feedback (30mins)* Control (*N* = 51) Alcohol education website *1 x 30min session* AC-R	(1) Quantity, (2) Peak quantity, (3) Frequency of intoxication *3mth follow-up*	Quantity, Peak quantity & Frequency of intoxication CDI high-risk drinkers reported greater pre-post reductions than control high-risk drinkers
Doumas et al. (2011) *Published Article*	1 *US*	First year undergraduate students *Enrolled on one of two orientation sections*	Female (65%); 17-19yrs old (*M* = 18.0yrs, *SD* = 0.45yrs); 1st year (100%); Caucasian (90%), Hispanic (4%), Asian American (3%), Other (3%)	CDI (*N* = 167) Student specific PNF (e-CHUG) *Immediate feedback (30mins)* Control (*N* = 183) AO	(1) Quantity, (2) Peak quantity, (3) Frequency of intoxication, (4) Negative consequences *3mth follow-up*	Peak quantity, Frequency of intoxication & Negative consequences CDI high-risk drinkers reported greater pre-post reductions than control high-risk drinkers
Hagger et al. (2012) *Published Article*	1 *UK*	Undergraduate students *All eligible*	Female (58%); *M* = 20.32yrs, *SD* = 2.50yrs	CDI 1 (*N* = 107) Mental simulation and implementation intention tasks *1 session* CDI 2 (*N* = 164) Implementation intention task *1 session*	(1) Quantity, (2) Frequency of binge drinking *1mth follow-up*	Quantity & Frequency of binge drinking At 1mth, CDI 1 & CDI 3 < CDI 2 & Control

				<u>CDI 3 (*N* = 169)</u> Mental simulation task *1 session* <u>Control (*N* = 269)</u> AO		
Hedman (2007) *Dissertation*	1 *US*	Health, sport and exercise students *18-23yrs old, report ≥ 1 binge drinking episode in the previous 2wks*	Female (58%); 18-23yrs old (*M* = 19.46yrs); 1st year (26%), 2nd year (37%), 3rd year (26%), 4th year (11%); White/Non-Hispanic (93%), Black/Non-Hispanic (2%), Hispanic (2%), Asian (1%), Indian (2%)	<u>CDI (*N* = 68)</u> PNF plus health communication messages *1 x feedback email + 2 x health communication emails per week* <u>Control (*N* = 63)</u> Alcohol facts *2 x emails per week* AC-R	(1) Frequency of drinking days, (2) Average quantity per drinking day, (3) Frequency of binge drinking *6wk Follow-up*	<u>Average quantity per drinking day</u> Control reported significant pre-post increases
Hester et al. (2012) *Published Article*	1 *US*	Students *18-24yrs old, report ≥ 1 binge drinking episode in the previous 2wks, an estimated peak BAC of ≥ 80mg%, not mandated to an alcohol intervention, had a significant other to corroborate their self-reported drinking*	<u>Study 1</u> Female (38%); CDI: *M* = 20.51yrs (*SD* = 1.8yrs), Control: *M* = 20.29yrs (*SD* = 1.63yrs); 1st year (29%), 2nd year (24%), 3rd year (26%), 4th year (16%), 5th year (6%); White (56%), Hispanic or Latino (29%), Mixed (7%), Black (6%), Native	<u>Study 1</u> <u>CDI (*N* = 65)</u> Multicomponent program (CDCU) *1 x session* <u>Control (*N* = 79)</u> AO	<u>Study 1</u> (1) Quantity, (2) Peak BAC, (3) Quantity when binge drinking, (4) Peak BAC when binge drinking *1mth & 12mth† follow-ups*	<u>Study 1</u> <u>Quantity</u> At 12mths, CDI < controls (*ns* following Bonferroni corrections) <u>Peak BAC</u> At 1mth, CDI < controls (*ns* following Bonferroni corrections) <u>Quantity when binge</u>

	American (2%), Asian American (1%), Hawaiian/Pacific Islander (1%)			drinking At 1mth and 12mths, CDI < controls (*ns* following Bonferroni corrections) Peak BAC when binge drinking At 1mth & 12mths, CDI < controls (*ns* at 12mths following Bonferroni corrections)
	Study 2	Study 2	Study 2	Study 2
	Female (44%); CDI: *M* =20.02yrs (*SD* = 1.52yrs), Control: *M* = 20.28yrs (*SD* = 2.09yrs); 1st year (39%), 2nd year (20%), 3rd year (18%), 4th year (20%), 5th year (4%); White (46%), Hispanic/Latino (38%), Mixed (9%), Black (2%), Native American (2%), Asian American (1%)	CDI (*N* = 42) Multicomponent program (CDCU) *1 x session* Control (*N* = 40) DAO	(1) Quantity, (2) Peak BAC, (3) Quantity when binge drinking, (4) Peak BAC when binge drinking *1mth follow-up*	Quantity, Peak BAC, Quantity when binge drinking & Peak BAC when binge drinking At 1mth, CDI < controls

Hustad et al. (2010) *Published Article*	1 *US*	Incoming first year undergraduate students *≥ 18yrs old, first-time college students, attended high school in the US*	Female (51%); *M* = 18.10yrs (*SD* = 0.30yrs); 1st year (100%); White (89%)	<u>CDI 1 (*N* = 31)</u> Student specific PNF (e-CHUG) *Immediate feedback* <u>CDI 2 (*N* = 26)</u> Multicomponent program (AlcEdu) *Continual access* <u>Control (*N* = 25)</u> AO	(1) Average quantity per drinking day, (2) Peak quantity, (3) Quantity, (4) Frequency of binge drinking, (5) Average BAC, (6) Peak BAC (7) Negative consequences *1mth follow-up*	<u>Average quantity per drinking day, Peak quantity, Quantity, Frequency of binge drinking, Average BAC & Peak BAC</u> CDI 1 & CDI 2 < controls
Kypri et al. (2008) *Published Article*	1 *NZ*	Students attending a university health care service *Score ≥ 8 on the AUDIT*	Female (52%); CDI 1: *M* = 20.1yrs (*SD* = 1.9yrs), CDI 2: *M* = 20.1yrs (*SD* = 1.9yrs), Control: *M* = 20.1yrs (*SD* = 2.2yrs)	<u>CDI 1 (*N* = 145)</u> Student specific PNF plus boosters *Immediate feedback + 2 x feedback boosters emails* <u>CDI 2 (*N* = 138)</u> Student specific PNF *Immediate feedback* <u>Control (*N* = 146)</u> Alcohol information leaflet AC-R	(1) Quantity, (2) Average quantity per drinking day, (3) Frequency of drinking days, (4) Frequency of binge drinking, (5) Negative consequences, (6) Academic consequences *6mth & 12mth† follow-ups*	<u>Quantity & Frequency of drinking days</u> At 6mths, CDI 1 & CDI 2 < controls <u>Frequency of binge drinking</u> At 6mths, CDI 1 < controls <u>Academic consequences</u> At 6mths & 12mths, CDI 1 & CDI 2 < controls <u>Problem drinking</u> At 12mths, CDI 1 & CDI 2 < controls

Kypri et al. (2013) *Published Article*	7 *NZ*	Maori students *17-24yrs old, score ≥ 4 on the AUDIT-C*	<u>Gender</u> CDI: Female (64%), Control: Female (67%); CDI: *M* = 20.2yrs (*SD* = 1.8yrs), Control: *M* = 20.1yrs (*SD* = 1.7yrs)	<u>CDI (*N* = 939)</u> Gender, age & student specific PNF (THRIVE) *Immediate feedback* <u>Control (*N* = 850)</u> AO	(1) Quantity, (2) Average quantity per drinking day, (3) Frequency of drinking days, (4) Academic consequences *5mth follow-up*	<u>Quantity, Frequency of drinking days & Academic consequences</u> CDI < controls
Kypri et al. (2004) *Published Article*	1 *NZ*	Students attending a university health service *17-26yrs old, score ≥ 8 on the AUDIT, report ≥ 1 binge drinking episode in the previous 1mth*	Female (50%); CDI: *M* = 19.9yrs (*SD* = 1.4yrs), Control: *M* = 20.4yrs (*SD* = 1.8yrs)	<u>CDI (*N* = 51)</u> Student specific PNF *Immediate feedback* <u>Control (*N* = 53)</u> Alcohol information leaflet AC-R	(1) Quantity, (2) Average quantity per drinking day, (3) Frequency of drinking days, (4) Frequency of binge drinking, (5) Negative consequences, (6) Academic consequences *6wk & 6mth† follow-ups*	<u>Quantity & Frequency of binge drinking</u> At 6wks, CDI < controls <u>Average quantity per drinking day</u> At 6mths, all participants reported reductions <u>Negative consequences</u> At 6wks & 6mths, CDI < controls
Lau-Barraco & Dunn (2008)	1 *US*	Undergraduate psychology students *Report ≥ 2 binge*	Female (57%); *M* = 19.88yrs, *SD* = 2.08yrs; 1st year (41%), 2nd year	<u>CDI (*N* = 39)</u> Multicomponent program (Alc101) *1 x 90-120min session*	(1) Quantity, (2) Frequency of binge drinking	*NS*

Published Article		*drinking episodes in the previous 1mth, consume ≥ 5 but < 40 drinks per week, no history of alcohol treatment*	(22%), 3rd year (28%), 4th year (9%); Caucasian (76%), Hispanic (13%)	Control (N = 64) Neutral tasks *1 x 90-120min session* AC-NR	*1mth follow-up*	
Lewis (2005); Lewis & Neighbours (2007)* *Dissertation & Published Article*	1 *US*	Psychology students *Report ≥ 1 binge drinking episode in the previous 1mth*	Female (55%); *M* = 20.1yrs (*SD* = 1.8yrs); White (97%), Other (3%)	CDI 1 (N_{Male} = 33, N_{Female} = 32) Gender & student specific PNF *Immediate feedback* CDI 2 (N_{Male} = 21, N_{Female} = 39) Student specific PNF *Immediate feedback* Control (N_{Male} = 30, N_{Female} = 27) AO	(1) Quantity, (2) Average quantity per drinking day, (3) Composite alcohol consumption measure *1mth follow-up*	Quantity, Average quantity per drinking day & Composite alcohol consumption measure CDI 1 & CDI 2 reported greater pre-post reductions than controls
Lewis et al. (2007) *Published Article*	1 *US*	Incoming first year undergraduate students *Enrolled on an orientation course, report ≥ 1 binge drinking episode in the previous 1mth*	Female (52%); *M* = 18.53yrs (*SD* = 2.04yrs); 1st year (100%); Caucasian (100%)	CDI 1 (*N* = 75) Gender & freshmen specific PNF *Immediate feedback* CDI 2 (*N* = 82) Freshmen specific PNF *Immediate feedback* Control (*N* = 88) AO	(1) Quantity, (2) Frequency of drinking days *5mth follow-up*	Quantity CDI 1 < controls Average quantity per drinking day CDI 1 & CDI 2 < controls

Martens et al. (2010) *Published Article*	3 *US*	Undergraduate intercollegiate athletes *All eligible*	Female (76%); *M* = 19.99yrs (*SD* = 1.52yrs); 1st year (32%), 2nd year (23%), 3rd year (18%), 4th year (26%); White (86%), Asian/Pacific Islander (5%), Hispanic/Latino (2%), Black/African American (2%), Other (6%)	CDI 1 (*N* = 96) Student athlete specific PNF *1 x feedback email* CDI 2 (*N* = 80) Student specific PNF *1 x feedback email* Control (*N* = 87) Alcohol information *1 x email* AC-R	(1) Quantity, (2) Peak BAC, (3) Negative consequences *1mth & 6mth† follow-ups*	Peak BAC At 6mths, CDI 1 < CDI 2 & controls
Meskew (2010) *Dissertation*	1 *US*	First year undergraduate students *All eligible*	Female (74%); *M* = 18.29yrs (*SD* = 1.53yrs); 1st year (100%); Caucasian (84%), Asian/Pacific Islander (7%), Hispanic/Latino (5%), American Indian/Alaskan Native (1%), Other/Mixed (4%)	CDI (*N* = 152) Student specific PNF (e-CHUG) *Immediate feedback (30mins)* Control (*N* = 88) AO (no intervention)	(1) Problem drinking *3wk & 3mth† post-test only*	Problem drinking At 3wks, CDI < controls
Mignogna (2010) *Dissertation*	1 *US*	Undergraduate students *Report ≥ 1 binge drinking episode in the previous 1mth, ≥ 20 drinks per month, no*	Female (44%); *M* = 20.29yrs (*SD* = 1.86yrs); 1st year (34%), 2nd year (15%), 3rd year (28%), 4th year (23%); White (85%)	CDI (*N* = 37) Student specific PNF (DrAFT-CS) *Immediate feedback* Control 1 (*N* = 37) AO	(1) Quantity, (2) Quantity per drinking day, (3) Peak quantity, (4) Frequency of drinking days, (5) Peak BAC, (6)	Average quantity DrAFT-CS "low" in fear of negative evaluation (FNE) reported greater pre-post reductions than DrAFT-CS "medium" and "high" in FNE

		current treatment for substance use and/or emotional or behavioural problems		Control 2 (*N* = 33) EAO	Frequency of intoxication, (7) Negative consequences *10wk follow-up*	Negative consequences EAO "medium" drinkers reported greater pre-post reductions than EAO "heavy" drinkers. AO "medium" drinkers reported greater pre-post reductions than AO "light" & "heavy" drinkers
`Moreira et al. (2012) *Published Article*	22 *UK*	First and second year undergraduate students *All eligible*	Female (62%); 17-19yrs (60%), 20-24yrs (34%), 25yrs+ (6%)	CDI (*N* = 872) Student specific PNF *1 x feedback email* Control (*N* = 879) AO	(1) Average quantity per drinking day, (2) Frequency of drinking days, (3) Problem drinking, (4) Negative consequences *6mth & 12mth† follow-ups*	*NS*
Murphy et al. (2010)*; Monahan et al. (2013) *Published Articles*	1 *US*	Undergraduate students *Enrolled on introductory classes, ≥18yrs old, report ≥ 1 binge drinking episode*	Female (50%); *M* =18.6yrs (*SD* = 1.2yrs); 1st year (98%), 2nd year (2%); Caucasian (65%), African American (30%),	CDI (*N* = 45) Student specific PNF (e-CHUG) *Immediate feedback (30mins)* Control (*N* = 42)	(1) Quantity, (2) Frequency of binge drinking *1mth follow-up*	*NS*

		in the previous 1mth	Hispanic/Latino (2%), Native American (2%), Hawaiian (1%), Asian (1%)	AO		
Neighbors et al. (2006) *Published Article*	1 *US*	Undergraduate psychology students *Report ≥ 1 binge drinking episode in the previous 1mth*	Female (56%); *M* = 19.67yrs (*SD* = 2.02yrs); 1st year (60%), 2nd year (25%), 3rd year (9 %), 4th year (6%); Caucasian (98%), Other (2%)	CDI (*N* = 108) Student specific PNF *Immediate feedback* Control (*N* = 106) AO	(1) Quantity, (2) Negative consequences *2mth follow-up*	Quantity CDI < controls
Palfai et al. (2011) *Published Article*	1 *US*	Psychology students *Report consuming alcohol in the previous 1mth and score ≥ 8 on the AUDIT or reported ≥ 2 binge drinking episodes in the previous 1mth*	Female (70%); *M* = 18.6yrs (*SD* = 1.45yrs); Caucasian (80%), Asian/Pacific Islander (14%), Hispanic (5%), Black (1%)	CDI (*N* = 56) Student & gender specific PNF *Immediate feedback* Control (*N* = 63) Sleep and fruit and vegetable information AC-NR	(1) Quantity, (2) Frequency of binge drinking *1mth follow-up*	Quantity & Frequency of binge drinking CDI that reported high negative consequences reported significant pre-post reductions
Paschall et al. (2011a)*; Paschall et al. (2011b)* *Published Articles*	30 *US*	First year undergraduate students *≥18yrs old*	Female (55%); *M* = 18.7yrs (*SD* = 0.8yrs); 1st year (100%); White (71%), Hispanic (11%), Asian (7%), Black (5%), Other (4%)	CDI (*N* = 1,102) Multicomponent program (AlcEdu) *2 x 2-3hr sessions* Control (*N* = 1,298) AO	(1) Average quantity per drinking day, (2) Frequency of drinking days, (3) Frequency of binge drinking, (4) Negative consequences	Frequency of drinking days, Frequency of binge drinking, Negative consequences At 6mths, CDI < controls

					6mth & 12mth† follow-ups	
Paschall et al. (2006)*; Bersamin et al. (2007) *Published Articles*	1 *US*	Incoming first year undergraduates *≥ 18yrs old*	Female (52%); *M* = 18.06yrs (*SD* = 0.31yrs); 1st year (100%); Asian (42%), White (30%), Hispanic (17%), Black (3%), Other (8%)	<u>CDI (*N* = 310)</u> Multicomponent program (College Alc) *Continual access (6wks)* <u>Control (*N* = 312)</u> AO	(1) Frequency of drinking days, (2) Frequency of binge drinking, (3) Frequency of intoxication, (4) Negative consequences *10wk Follow-up*	*NS*
Pedersen (2012) *Dissertation*	1 *US*	Students studying abroad *Studying for ≈ 3mths in 1/30 pre-determined countries*	Female (78%); *M* = 21.14yrs (*SD* = 3.11yrs); 1st year (1%), 2nd year (15%), 3rd year (38%), 4th year (43%), Graduate (3%); Caucasian/White (72%), Asian/Pacific Islander (14%), Mixed (7%), Hispanic/Latino (2%), African American/Black (2%), Native American/Alaskan Native/Other (3%)	<u>CDI 1 (*N* = 85)</u> Region (abroad student) & country-specific (adult) PNF plus Sojourner adjustment feedback *Continual access* <u>CDI 2 (*N* = 82)</u> Region (abroad student) & country-specific (adult) PNF *Continual access* <u>CDI 3 (*N* = 84)</u> Sojourner adjustment feedback *Continual access*	(1) Quantity (2) Negative consequences *1mth†, ≈ 3mth & ≈ 4mth† follow-ups*	<u>Quantity</u> CDI 3 reported greater pre-post increases than controls <u>Negative consequences</u> CDI 2 showed a trend for pre-post reductions compared to controls

				Control (*N* = 86) AO		
Sharmer (2001) *Published Article*	1 *US*	Undergraduate students *≥ 18yrs old, enrolled on 1/9 Tuesday morning classes*	Female (60%); 18-23yrs (90%; *Mdn* = 20yrs)	CDI (*N* = 92) Multicomponent program (Alc101) *1 x 60min session* Control (*N* = 102) AO	(1) Composite alcohol consumption measure *4wk†, 8wk & 12wk† follow-ups*	*NS*
Sugarman (2009) *Dissertation*	1 *US*	Students *≥ 18yrs old, report ≥ 2 binge drinking episode in the previous 1mth*	Female (56%); *M* = 19.2yrs (*SD* = 1.4yrs); 1st year (51%), 2nd year (25%), 3rd year (15%), 4th year (7%), Graduate (2%); White (83%), Asian/Pacific Islander (9%), African American (2%), Native American/Alaskan (1%), Other (6%)	CDI (*N* = 186) Student & gender specific PNF *1 x feedback email* Control (*N* = 207) General health information *1 x email* AC-NR	(1) Quantity, (2) Average quantity per drinking day, (3) Average BAC, (4) Peak BAC, (5) Frequency of binge drinking, (6) Negative consequences *1mth† & 2mth follow-ups*	Average BAC At 1mth, CDI < controls
Todd & Mullan (2011) *Published Article*	1 *AU*	Female students *< 25yrs old*	Female (100%); 17-25yrs old, *M* = 19yrs, *SD* = 1.5yrs	CDI (*N* = 44) Binge drinker prototype manipulation + TPB *1 session* Control 1 (*N* = 36)	(1) Quantity *2-3wk follow-up*	Quantity Control 1 < Control 2

				Water drinker prototype manipulation + TPB *1 session* AC-NR <u>Control 2 (*N* = 42)</u> Water consumption task *1 session* AC-NR		
Voogt et al. (2013) *Published Article*	Unknown *NL*	Students *18-24yrs old, report heavy drinking in the previous 6mths, motivated to change consumption, < 20 on the AUDIT, no previous treatment for alcohol-related problems*	Female (40%); *M* = 20.8yrs (*SD* = 1.7yrs); 1st year (21%)	<u>CDI (*N* = 456)</u> Multicomponent program (WDYD) *1 x 20min session* <u>Control (*N* = 451)</u> AO	(1) Quantity *1mth & 6mth† follow-ups*	*NS*
Wagener et al. (2012)*; Wagener (2013) *Published Article & Dissertation*	1 *US*	Undergraduate students *18-25yrs old, ≥ 1 binge drinking episode in the previous 1mth, ≥ 20 drinks per month on average, ≥ 1 negative consequence*	Female (45%); *M* = 20.9yrs (*SD* = 1.9yrs); 1st year (34%), 2nd year (16%), 3rd year (27%), 4th year (23%); White (85%)	<u>CDI (*N* = 39)</u> Student specific PNF (DrAFT-CS) *Immediate feedback* <u>Control 1 (*N* = 37)</u> EAO <u>Control 2 (*N* = 39)</u>	(1) Quantity, (2) Average BAC, (3) Peak BAC, (4) Peak quantity, (5), Frequency of drinking days, (6) Frequency of intoxication, (7) Negative	<u>Average BAC, Peak BAC, Peak quantity & Negative consequences</u> CDI showed significant pre-post reductions

		in the previous 1mth, no treatment for alcohol abuse or dependence or receiving treatment for a psychological or emotional disorder		AO	consequences *10wk follow-up*	
Wall (2005*; 2006; 2007) *Dissertation & Published Articles*	225 *US*	Various student target groups	Female (53%); 18yrs (66%), 19yrs (21%), 20yrs (8%), 21yrs (4%), 22yrs (1%); White (82%), African American/Black (3%), Asian/Pacific Islander (9%), Hispanic/Latino (5%), Indian/Native American (1%)	CDI (N = 15,446) Multicomponent program (AlcEdu) Control (N = 7,879) AO (no intervention)	(1) Quantity, (2) Frequency of binge drinking, (3) Frequency of hazardous drinking, (4) Academic consequences, (5) Negative consequences *Post-test only*	Quantity, Frequency of binge drinking, Frequency of hazardous drinking, Academic consequences & Negative consequences CDI < controls
Walters et al. (2007) *Published Article*	1 *US*	First year undergraduate students *≥ 1 binge drinking episode in the previous 1mth*	Female (48%); 1st year (100%); Caucasian (73%)	CDI (N_{Male} = 25, N_{Female} = 25) Student specific PNF (e-CHUG) *Immediate feedback* Control (N_{Male} = 30, N_{Female} = 26) AO	(1) Quantity, (2) Peak BAC, (3) Negative consequences *8wk & 16wk† follow-ups*	Average quantity & Peak BAC At 8wks, CDI < controls

Walters et al. (2009) *Published Article*	1 *US*	Undergraduate students *≥18yrs old, ≥ 1 binge drinking episode in the previous 2wks*	Female (64%); *M* = 19.8yrs; 1st year (41%), 2nd year (21%), 3rd year (22%), 4th year (16%); White (85%)	CDI (*N* =67) Student specific PNF (e-CHUG) *Immediate feedback* Control (*N* = 69) AO	(1) Quantity, (2) Peak BAC, (3) Negative consequences *3mth & 6mth† follow-ups*	*NS*
Weaver (2011) *Dissertation*	1 *US*	Undergraduate psychology students *18-25yrs old, consume alcohol, ≥ 1 binge drinking episode in the previous 1mth, ≥ 20 drinks per month on* *average, ≥ 1 negative consequence in the previous 1mth*	Female (50%); CDI 1: *M* = 19.96yrs (*SD* = 1.32yrs), CDI 2: *M* = 19.72yrs (*SD* = 1.49yrs), CDI 3: *M* = 18.92yrs (*SD* = 1.4yrs), Control: *M* = 19.4yrs (*SD* = 1.32yrs); 1st year (41%), 2nd year (35%); White (86%)	CDI 1 (*N* = 28) Student specific PNF (DrAFT-CS) plus Moderation skills *Immediate feedback + video* CDI 2 (*N* = 32) Student specific PNF (DrAFT-CS) *Immediate feedback* CDI 3 (*N* = 28) Moderation skills *Video* Control (*N* = 27) AO	(1) Quantity, (2) Peak quantity, (3) Peak BAC, (4) Average BAC, (5) Problem drinking, (6) Negative consequences *1mth follow-up*	Quantity, Peak quantity, Peak BAC, Average BAC & Problem drinking All reported reductions

Weitzel et al. (2007) *Published Article*	1 *US*	Students *≥ 18yrs old, consume alcohol > once per week, identify as US citizens*	Female (56%); *M* = 19.2yrs; 1st year (23%), 2nd year (54%), 3rd year (13%), 4th year (10%); White (77%), Black (13%), Asian (5%), Hispanic (3%), Other (3%)	CDI (*N* = 20) Diary plus messages *Daily message (2wks)* Control (*N* = 20) Diary AO	(1) Quantity, (2) Average quantity per drinking day, (3) Frequency of drinking days, (4) Negative consequences, (5) Negative consequences per day *2wk follow-up*	*NS*

***** The study used to obtain meta-analysis data when more than one study reports results on a CDI evaluation*; †* Data not included in the meta-analyses

[a] SE = Sweden; UK = United Kingdom; US = United States; CA = Canada; NZ = New Zealand; AU = Australia; NL = Netherlands

[b] AC-NR = Non-Alcohol-Related Active Control; AC-R = Alcohol-Related Active Control; AO = Assessment Only; CDI = Computer-Delivered Intervention; DAO = Delayed Assessment Only; EAO = Extended Assessment Only; Alc101 = Alcohol 101; Alc101+ = Alcohol 101+; Alc&You = Alcohol and You; AlcEdu = Alcohol Edu; BASICS = Brief Alcohol Screening and Intervention of College Students; CDCU = College Drinker's Check Up; CYD = Check Your Drinking; CYD-U = Check Your Drinking – University; DrAFT-CS = Drinking Assessment and Feedback Tool for College Students; e-CHUG = electronic Check Up to Go; M-PASS = Michigan Prevention and Alcohol Safety for Students; MSB = My Student Body; PNF = Personalised Normative Feedback; THRIVE = Tertiary Health Research Intervention Via Email; TPB = Theory of Planned Behaviour measures; WDYD = What Do You Drink

Table 2. Summary of CDI evaluation characteristics.

	Control Condition					
	AO (*k* = 47)	AC-R (*k* = 10)	AC-NR (*k* = 7)	DAO (*k* = 2)	EAO (*k* = 2)	All (*k* = 68)
N	39,732	1,499	710	1,680	141	43,762
Country						
United States	36	7	5	1	2	51
United Kingdom	6	-	-	-	-	6
New Zealand	1	3	-	-	-	4
Australia	-	-	2	-	-	2
Canada	2	-	-	-	-	2
Sweden	1	-	-	1	-	2
Netherlands	1	-	-	-	-	1
Target Group: Year of Study						
All students	33	8	7	1	2	51
First year students	14	2	-	1	-	17
Target Group: Drinker Status						
All drinking statuses	22	5	2	1	0	30
Binge drinkers	18	2	2	1	2	25
Heavy/Risky drinkers	3	3	1	-	-	7
Drinkers	4	-	2	-	-	6
Intervention Type						
Multicomponent programs						
Alcohol Edu	5	0	0	0	0	5
Alcohol 101+;	1	-	1	-	-	2
Alcohol 101	1	-	1	-	-	2
College Drinker’s Check Up	1	-	-	1	-	2

College Alc	1	-	-	-	-	1
Brief Alcohol Screening and Intervention of College Students	-	1	-	-	-	1
Michigan Prevention and Alcohol Safety for Students	1	-	-	-	-	1
My Student Body	-	1	-	-	-	1
What Do You Drink	1	-	-	-	-	1
Alcohol 101+ plus booster(s)	-	-	1	-	-	1
Personalized normative feedback						
Student specific	18	4	-	1	2	25
Gender & student specific	3	-	2	-	-	5
Gender, age & student specific	2	-	-	-	-	2
Gender & student specific (attitudinal)	1	-	-	-	-	1
Gender & student specific (behavioural)	1	-	-	-	-	1
Peer specific	-	1	-	-	-	1
First year student specific	1	-	-	-	-	1
Gender & first year student specific	1	-	-	-	-	1
Student & athlete specific	-	1	-	-	-	1
Student & Country specific	1	-	-	-	-	1
Student specific plus moderation skills	1	-	-	-	-	1
Student specific plus booster(s)	-	1	-	-	-	1
Student specific plus health communication messages	-	1	-	-	-	1
Student & Country specific plus sojourner adjustment feedback	1	-	-	-	-	1
Other interventions						
Binge drinker prototype manipulation	-	-	2	-	-	2
Mental simulation plus Implementation intentions	1	-	-	-	-	1
Mental simulation	1	-	-	-	-	1
Implementation intentions	1	-	-	-	-	1
Moderation skills	1	-	-	-	-	1
Sojourner adjustment feedback	1	-	-	-	-	1
Health communication message	1	-	-	-	-	1

AO = Assessment Only; AC-R = Alcohol-Related Active Control; AC-NR = Non-Alcohol-Related Active Control; DAO = Delayed Assessment Only; EAO = Extended Assessment Only

In such circumstances, the most comprehensive document was used to provide data for the analysis (indicated with a single asterisk in Table 1). In one instance, two published studies (Paschall, Antin, Ringwalt & Saltz, 2011a; Paschall, Antin, Ringwalt & Saltz, 2011b) that reported data for the same intervention (AlcoholEdu for college) versus assessment-only evaluation were both utilised for the analysis as one study provided data for alcohol consumption outcome measures (Paschall et al., 2011a) and the other provided data for alcohol-related negative consequences (Paschall et al., 2011b).

As shown in Table 2, the majority of CDI evaluations (69%) used an assessment-only (AO) control group, were conducted in the US (75%), and targeted students of all years of study (75%).

5.4.2. Overall Effectiveness

To examine overall effectiveness of CDIs, a mean between-group effect size for all outcomes reported, was calculated for each evaluation study. For example, outcomes such as quantity, frequency of drinking days, and negative consequences were combined to provide one overall effect size for each CDI evaluation (see Figure 2). As shown in Table 3, the weighted mean effect size for all outcomes was significant (δ = .11, 95% CI [.08, .15], $p < .001$), but lower than .20, deeming the difference between intervention and control group at follow-up to be negligible (i.e., less than small) according to Cohen's (1988) guidelines. This indicates that the interventions had little impact on outcomes. Of note, these findings also suggest that many of the intervention studies may have lacked statistical power as only 2 of the studies (Hester, Delaney, & Campbell, 2012; Kypri et al., 2013) show significant effects.

Further analyses examined the effectiveness of CDIs on primary outcomes (i.e., assessment of alcohol consumption behaviour) and secondary outcomes (i.e., assessment of the consequences of drinking behaviour, the subjective experience of

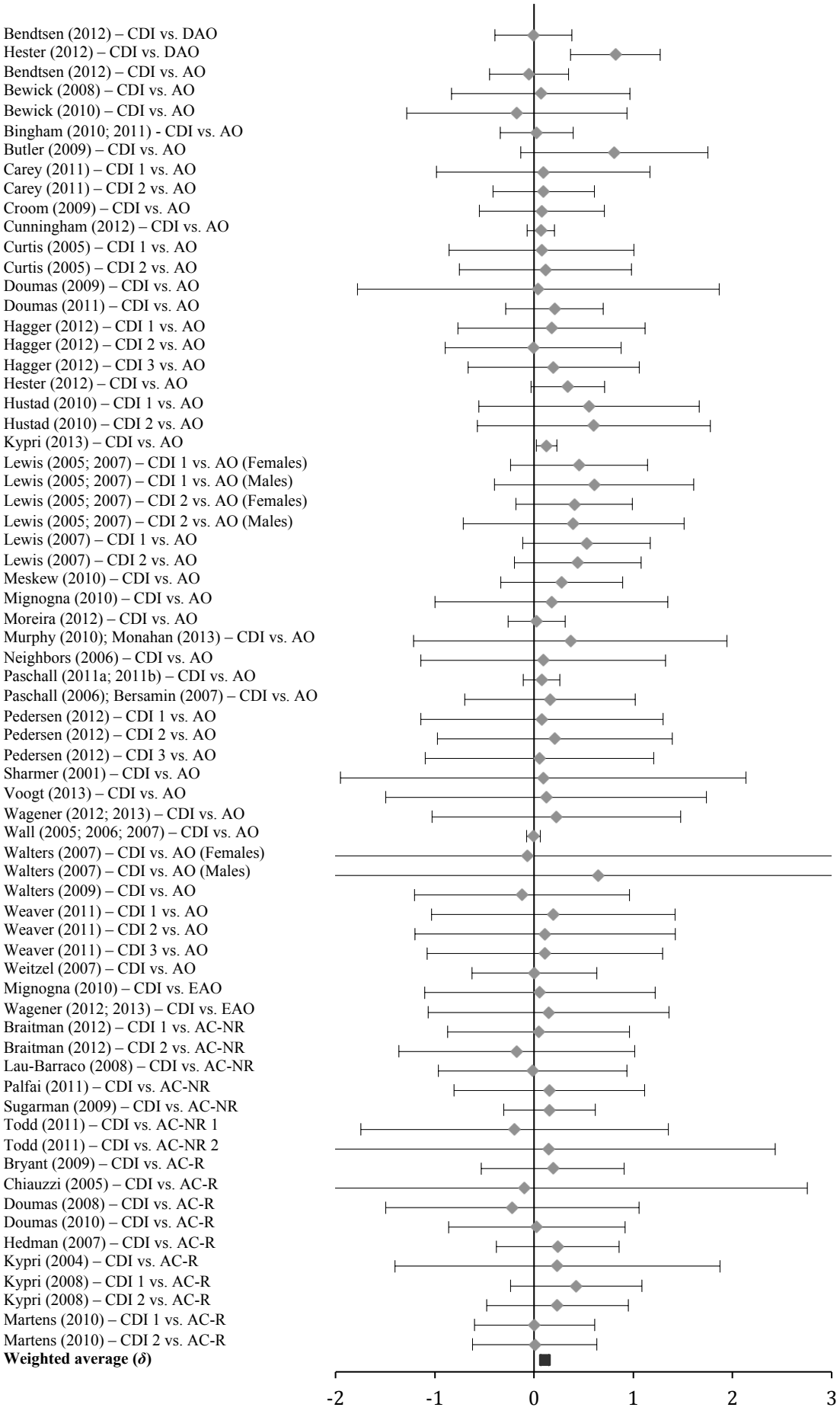

Figure 2. Unbiased standardised mean difference (d) and 95% CI for 'all outcomes' for each CDI evaluation.

Table 3. Mean weighted effect sizes for all outcomes, primary outcomes and secondary outcomes for all control conditions and across different control conditions.

	N	*k*	Range (*d*)	δ [95% CI]	*p*-value	Homogeneity (*Q*)
				CDI vs. All Controls		
All outcomes	43,763	68	-.22 – .82	.11 [.08, .15]	$p < .001$	127.97, $p < .001$
Primary outcomes	42,683	67	-.25 – .94	.14 [.09, .18]	$p < .001$	151.39, $p < .001$
Secondary outcomes	37,076	45	-.47 – .56	.04 [.02, .06]		57.18, $p = .09$
				CDI vs. AO		
All outcomes	39,732	47	-.17 – .81	.12 [.07, .16]	$p < .001$	97.73, $p < .001$
Primary outcomes	38,653	46	-.18 – .92	.14 [.08, .20]	$p < .001$	113.72, $p < .001$
Secondary outcomes	33,811	31	-.14 – .55	.04 [.02, .07]	$p < .001$	38.02, $p = .15$
				CDI vs. AC-NR		
All outcomes	710	7	-.20 – .16	.07 [-.08, .22]	$p = .17$	2.81, $p = .83$
Primary outcomes	710	7	-.25 – .17	.07 [-.08, .22]	$p = .18$	3.19, $p = .78$
				CDI vs. AC-R		
All outcomes	1,499	10	-.22 – .42	.14 [.04, .24]	$p = .004$	11.02, $p = .27$
Primary outcomes	1,499	10	-.10 – .51	.19 [.08, .29]	$p < .001$	11.50, $p = .24$
Secondary outcomes	1,204	8	-.45 – .40	.02 [-.19, .23]	$p = .43$	18.36, $p = .01$

N = total sample size; *k* = number of evaluations; *d* = Hedge's unbiased effect size ((1 - (3 / ((4 x *N*) - 9))) x ($M_{Control} - M_{Intervention} / SD_{Pooled}$)); δ = weighted average effect size; CDI = computer-delivered intervention; AO = assessment only; AC-R = alcohol-related active control; AC-NR = non-alcohol-related active control

consumption, and behaviours indicative of alcohol use disorders). As above, a single primary outcome and secondary outcome effect size was calculated (if possible) for each evaluation by averaging effect sizes of relevant reported outcomes. CDIs showed greater weighted mean effect size for primary outcomes (δ = .14, 95% CI [.09, .18], p < .001) than secondary outcomes (δ = .04, 95% CI [.02, .06], p < .001), indicating that interventions show greater reductions (relative to controls) for alcohol consumption behaviour than consequences of consumption or behaviour indicative of an alcohol use disorders. However, both showed significant effects less than .20.

Effect sizes were significantly heterogeneous when combining all outcomes (Q = 127.97, p < .001). The variability in effect sizes is shown in Figure 2. Further analyses indicated that the heterogeneity in the all outcomes effect sizes might be due to the significant variability observed for the primary outcomes effects (Q = 151.39, p < .001), as the secondary outcomes effects were homogeneous (Q = 57.18, p = .09).

5.4.3. Control Conditions

5.4.3.1. Range of control conditions. Five categories of control condition were identified in the included CDI evaluations. Assessment-only (AO) was the most common control condition (k = 47), and characterised by the completion of baseline and follow-up assessment items with the absence of an intervention. Alcohol-related active control conditions (AC-R; k = 10) provide control participants with alcohol-related educational material, or the same intervention with a different delivery mode. For example, Martens et al. (2010) provided control participants with an email containing alcohol-related information to compare with student athlete specific PNF and student specific PNF emails. Non-related active control conditions (AC-NR; k = 7) provide control participants with an alternative intervention or educational material that is not related to alcohol consumption. For example, Sugarman (2009) provides control

participants with a general health information email to compare with a student and gender specific PNF email. Carey et al. (2009) combined assessment-only and non-relevant content controls in their meta-analysis. This meta-analysis explored whether effect sizes may differ across these two types of control groups.

Two other control condition categories were defined, each accounting for two evaluations. Delayed assessment-only (DAO; $k = 2$) were similar to AO with the absence of providing participants with a baseline assessment (i.e., participants would only complete the follow-up assessment). Extended assessment-only control conditions (EAO; $k = 2$) were also similar to AO. However, participants assigned to EAO complete additional assessments (e.g., mid-intervention assessment) that are provided to intervention participants.

5.4.3.2. Effect sizes across control conditions. A series of meta-analyses examined the mean between-group effect sizes for all outcomes, primary outcomes, and secondary outcomes as defined above for CDI evaluations using each type of control condition (see Table 3). In instances where less than five CDI evaluations were identified (i.e., CDI versus DAO and CDI versus EAO), meta-analyses were not performed.

CDI versus AO evaluations were associated with significant effects under .20 for all outcomes, primary outcomes, and secondary outcomes. As in the previous analyses, effect sizes were larger for primary outcomes than secondary outcomes and, were significantly heterogeneous for all outcomes and primary outcomes. CDI versus AC-NR evaluations were associated with a homogeneous effect under .10 for all outcomes and primary outcomes that failed to reach significance. CDI versus AC-R evaluations were associated with significant homogeneous effects under .20 for all

outcomes and primary outcomes. The heterogeneous effect shown for secondary outcomes failed to reach significance.

Surprisingly, the mean between group effect for all outcomes and primary outcomes was larger for the CDI versus AC-R evaluations than CDI versus AO evaluations. This finding indicates that intervention participants show greater reductions at follow-up relative to control participants in all alcohol-related behaviour (i.e., all outcomes) and alcohol consumption behaviour specifically (i.e., primary outcomes) when the CDI evaluation utilises a control group that received alternative alcohol-related material (i.e., AC-R) compared to a control group that received no information or intervention (i.e., AO). However, it should be noted that the effect sizes are significantly heterogeneous for the CDI versus AO evaluations (i.e., the effect sizes varied greatly around these values) due to other study characteristics not accounted for in this analysis whereas, the mean effects of the CDI versus AC-R evaluations are consistently distributed.

5.4.4. Outcome Measures

5.4.4.1. Range of outcome measures. A total of 19 categories of outcomes were identified in 68 evaluations. Quantity of alcohol consumption was the most commonly used outcome ($k = 61$) and encompassed total or average quantity of alcohol consumed over a specified period of time (e.g., previous month, typical week). Other commonly used outcomes were negative consequences ($k = 38$), frequency of binge drinking ($k = 27$), quantity per drinking day ($k = 23$), frequency of drinking days ($k = 22$), and peak BAC ($k = 21$). Negative consequences were quantified with a score derived from multi-item scales measuring alcohol-related negative consequences or problems; the most common of which being the Rutgers alcohol problems index (RAPI; White & Labouvie, 1989), followed by the brief young adult alcohol consequences questionnaire (B-

YAACQ; Kahler, Strong, & Read, 2005). Frequency of binge drinking encompassed the total or average number of binge/heavy drinking episodes over a specified period of time (usually defined as ≥5 drinks for men and ≥4 drinks for women during one drinking occasion; Wechsler, Dowdall, Davenport & Rimm, 1995). Quantity per drinking day encompassed the total or average amount of alcohol consumed on days when any alcohol was consumed. Frequency of drinking days included the total or average number of days when any alcohol was consumed over a specified period of time. Peak BA is derived from the maximum value of estimated BAC using the following formula, where *no.* equals the number of drinks consumed, *GC* equals a constant depending on sex (9.0 for females, 7.5 for males), *lbs.* equals weight in pounds and *hrs.* equals the number of hours spent consuming alcohol: -

$$\text{Estimated BAC} = ((no. / 2) \times (GC / lbs.)) - (0.016 \times hrs.)$$

Less commonly used outcomes included peak quantity ($k = 19$), frequency of intoxication ($k = 12$), average BAC ($k = 10$), problem drinking ($k = 9$), and composite alcohol consumption measure ($k = 7$). Peak quantity measured the maximum number of drinks consumed over a specified period of time. Frequency of intoxication encompassed the total or average number of times respondents felt “drunk” over a specified period of time. Average BAC is derived from the average value of estimated BAC using the formula above. Problem drinking was quantified with a score derived from multi-item scales designed to identify problematic drinking behaviour including level of risk associated with alcohol consumption using the Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) and risk for alcoholism using the CAGE questionnaire (Ewing, 1984). Composite alcohol consumption measures were quantified using a score derived from measures of different aspects of drinking behaviour such as quantity, frequency, and number of heavy

drinking episodes. Composite alcohol consumption scales included the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C; Bush, Kivlahan, McDonell, Fihn & Bradley, 1998) and the Alcohol Consumption Inventory (ACI; Knee & Neighbors, 2002). Rarely used outcomes not included in the individual analyses were academic consequences (k = 5), quantity when binge drinking (k = 2), peak BAC when binge drinking (k = 2), quantity during special occasions (k = 1), peak quantity at special occasions (k = 1), frequency of hazardous drinking (k = 1), frequency of light-headedness (k = 1), and negative consequences per day (k = 1).

5.4.4.2. Effect sizes across outcome measures and control conditions. A series of meta-analyses examined the mean between-group effect sizes for each type of alcohol-related outcome by the type of control condition used (see Table 4). Meta-analyses could not be conducted on any outcomes for CDI versus DAO evaluations or CDI versus EAO evaluations due to the lack of comparisons available. Meta-analyses were not performed for CDI versus AC-NR evaluations as the previous analysis indicated that the difference between intervention and control groups for all outcomes and primary outcomes at follow-up failed to reach significance.

For CDI versus AO evaluations, mean between-group effect sizes for the individual outcomes ranged from .02 to .32. Small significant homogenous effects were revealed for peak quantity, average BAC, peak BAC, and composite alcohol consumption measures. Intervention participants were shown to demonstrate the greatest reduction relative to control participants in peak BAC at follow-up. Significant effects under .20 were shown for quantity, frequency of drinking days, quantity per drinking day, frequency of binge drinking, and negative consequences. With the exception of negative consequences, effect sizes were shown to be significantly

Table 4. Average weighted effect sizes for each outcome measure for each type of control condition.

	N	*k*	Range (*d*)	δ [95% CI]	*p*-value	Homogeneity (*Q*)
				CDI vs. AO		
Primary outcomes						
Quantity	33,992	41	-.20 – 1.05	.17 [.09, 25]	$p < .001$	122.21, $p < .001$
Quantity per drinking day	7,924	16	-.20 – .73	.08 [-.01, .17]	$p = .04$	26.76, $p = .03$
Peak quantity	1,321	12	.09 – .63	.20 [.10, .31]	$p < .001$	6.65, $p = .83$
Average BAC	996	8	.14 – .72	.24 [.12, .36]	$p < .001$	5.83, $p = .56$
Peak BAC	1,408	13	-.16 – .98	.32 [.17, .48]	$p < .001$	17.76, $p = .12$
Frequency of drinking days	6,154	12	-.27 – .76	.19 [.04, .34]	$p = .01$	22.21, $p = .02$
Frequency of binge drinking	28,557	15	-.13 – .96	.14 [.00, .28]	$p = .02$	43.23, $p < .001$
Composite alcohol consumption measure	848	6	.07 – .64	.20 [.06, .33]	$p = .002$	5.11, $p = .40$
Secondary outcomes						
Frequency of intoxication	651	5	-.20 – .15	.08 [-.07, .24]	$p = .15$	1.55, $p = .82$
Problem drinking	3,047	7	-.31 – .42	.02 [-.11, .15]	$p = .39$	14.62, $p = .02$
Negative consequences	30,157	27	-.19 – .55	.04 [.02, .07]	$p < .001$	21.93, $p = .69$
				CDI vs. AC-R		
Primary outcomes						
Quantity	1,423	9	-.14 – .30	.15 [.05, .26]	$p = .002$	8.18, $p = .42$
Quantity per drinking day	858	5	-.13 – .42	.17 [-.01, .35]	$p = .002$	8.46, $p = .08$
Frequency of drinking days	1,049	6	-.19 – .57	.29 [.06, .51]	$p = .01$	22.01, $p < .001$
Frequency of binge drinking	1,049	6	-.11 – .85	.18 [-.09, .46]	$p = .10$	28.99, $p < .001$
Secondary outcomes						
Negative consequences	1,065	6	-.32 – .49	.02 [-.22, .25]	$p = .44$	12.83, $p = .03$

N = total sample size; *k* = number of evaluations; *d* = Hedge's unbiased effect size ((1 - (3 / ((4 x *N*) - 9))) x ($M_{Control} - M_{Intervention} / SD_{Pooled}$)); δ = weighted average effect size; CDI = computer-delivered intervention; AO = assessment only; AC-R = alcohol-related active control

heterogeneous. Frequency of intoxication and problem drinking reductions failed to reach significance.

For CDI versus AC-R evaluations, mean between-group effect sizes for the individual outcomes ranged from .02 to .29. A small significant heterogeneous effect was revealed for frequency of drinking days. Quantity and quantity per drinking day were associated with significant homogeneous effects below .20, and the intervention-control group difference at follow-up for frequency of binge drinking and negative consequences failed to reach significance.

These findings illustrate the variability in effect sizes for the different outcomes used in CDI evaluations. CDI versus AO evaluations are shown to yield stronger evidence of small significant homogeneous effects than CDI versus AC-R evaluations. Of note, there is still marked heterogeneity in the effect sizes for a few of the outcome categories, which necessitates further examination of study characteristics that may be moderating CDI efficacy

5.4.5. Potential Moderators

A further series of meta-analyses were conducted to examine the between-group effect sizes of individual outcomes separated by potential moderators (country, year of study, drinker status and intervention type). Analyses were only conducted on CDI versus AO evaluations (see Table 5) due to the lack of comparisons available for CDI evaluations using other control conditions. Arguably, using AO control conditions also provide a more precise reflection of the effect of the CDI (i.e., versus no intervention).

5.4.5.1. Country. Mean between-group effect sizes for individual alcohol-related outcomes among US students varied between .04 and .32. Small significant effects were shown for quantity, peak quantity, average BAC, peak BAC, frequency of drinking days, frequency of binge drinking, and composite alcohol consumption measures. US

Table 5. Average weighted effect size for each outcome measure separated by potential moderators for CDI versus AO evaluations.

	N	*k*	Range (*d*)	δ [95% CI]	*p*-value	Homogeneity (*Q*)
				Country		
US						
Primary outcomes						
Quantity	27,956	31	-.20 - 1.05	.22 [.11, .32]	$p < .001$	91.86, $p < .001$
Quantity per drinking day	4,628	12	-.03 - .73	.09 [.00, .18]	$p = .03$	14.64, $p = .20$
Peak quantity	1,160	10	.09 - .63	.21 [.09, .32]	$p < .001$	6.43, $p = .70$
Average BAC	996	8	.14 – .72	.24 [.12, .36]	$p < .001$	5.83, $p = .56$
Peak BAC	1,408	13	-.16 - .98	.32 [.17, .48]	$p < .001$	17.76, $p = .12$
Frequency of drinking days	3,706	8	-.27 - .76	.25 [.02, .48]	$p = .02$	20.98, $p = .004$
Frequency of binge drinking	27,282	10	-.04 - .96	.21 [.03, .39]	$p = .01$	39.10, $p < .001$
Secondary outcomes						
Frequency of intoxication	651	5	-.20 – .15	.08 [-.07, .24]	$p = .15$	1.55, $p = .82$
Composite alcohol consumption measure	848	6	.07 – .64	.20 [.06, .33]	$p = .004$	5.11, $p = .40$
Negative consequences	29,120	24	-.19 - .55	.04 [.02, .07]	$p < .001$	20.26, $p = .63$
Non-US						
Primary outcomes						
Quantity	6,036	10	-.14 - .27	.07 [.02, .13]	$p = .002$	21.08, $p = .01$
Frequency of binge drinking	1,275	5	-.13 - .14	.02 [-.09, .14]	$p = .36$	3.85, $p = .43$
				Year of Study		
First year students						
Primary outcomes						
Quantity	4,745	12	-.06 - .84	.22 [.07, .37]	$p = .002$	27.98, $p = .003$
Frequency of binge drinking	4,099	6	.06 - .55	.15 [.03, .28]	$p = .01$	7.31, $p = .20$
Secondary outcomes						

Negative consequences	4,002	9	-.11 - .55	.10 [.04, .16]	$p < .001$	3.96, $p = .86$
All years						
Primary outcomes						
Quantity	29,247	29	-.20 – 1.05	.16 [.06, .25]	$p < .001$	88.95, $p < .001$
Quantity per drinking day	4,314	12	-.20 - .37	.04 [-.02, .10]	$p = .08$	16.78, $p = .11$
Peak quantity	1,135	9	.09 - .39	.16 [.04, .27]	$p = .004$	1.79, $p = .99$
Average BAC	892	6	.14 - .38	.19 [.06, .33]	$p = .002$	1.03, $p = .96$
Peak BAC	1,228	9	-.16 - .62	.25 [.14, .36]	$p < .001$	9.13, $p = .33$
Frequency of drinking days	2,691	8	-.27 - .76	.11 [-.07, .29]	$p = .11$	7.86, $p = .34$
Frequency of binge drinking	24,458	9	-.13 - .96	.10 [-.11, .31]	$p = .17$	21.16, $p = .01$
Composite alcohol consumption measure	848	6	.07 – .64	.20 [.06, .33]	$p = .004$	5.11, $p = .40$
Secondary outcomes						
Negative consequences	26,155	18	-.19 - .48	.03 [.01, .06]	$p = .01$	13.71, $p = .69$
				Drinker Status		
Binge/heavy drinkers						
Primary outcomes						
Quantity	3,811	20	-.20 - 1.05	.30 [.16, .44]	$p < .001$	36.57, $p = .01$
Quantity per drinking day	1,728	6	.08 - .37	.12 [.02, .21]	$p = .01$	2.67, $p = .75$
Peak quantity	308	5	.09 - .39	.22 [.00, .45]	$p = .03$	0.90, $p = .92$
Peak BAC	644	9	-.16 - .98	.31 [.10, .52]	$p = .002$	13.31, $p = .10$
Frequency of drinking days	1,906	6	.07 - .76	.33 [.10, .57]	$p = .003$	15.03, $p = .01$
Composite alcohol consumption measure	664	5	.07 - .64	.17 [.01, .32]	$p = .03$	4.50, $p = .34$
Secondary outcomes						
Negative consequences	745	10	-.11 - .48	.12 [-.03, .26]	$p = .06$	4.51, $p = .88$
All drinker statuses						
Primary outcomes						
Quantity	28,788	17	-.13 - .77	.09 [.00, .17]	$p = .02$	40.27, $p < .001$
Quantity per drinking day	4,803	6	-.03, .73	.17 [-.07, .41]	$p = .08$	10.66, $p = .06$
Peak quantity	347	5	.12 - .63	.36 [.14, .57]	$p < .001$	2.56, $p = .63$

Frequency of drinking days	4,209	5	.05 - .16	.08 [.02, .14]	$p = .01$	0.78, $p = .94$
Frequency of binge drinking	27,758	11	-.13 - .55	.07 [-.04, .18]	$p = .10$	25.44, $p = .005$
Secondary outcomes						
Negative consequences	28,707	14	-.11 - .55	.04 [.02, .07]	$p < .001$	13.12, $p = .44$
			Type of Intervention			
PNF						
Primary outcomes						
Quantity	5,588	25	-.20 – 1.05	.26 [.14, .38]	$p < .001$	69.99, $p < .001$
Quantity per drinking day	3,663	10	-.20 - .56	.06 [-.02, .14]	$p = .08$	19.39, $p = .02$
Peak quantity	500	7	.09 - .54	.25 [.07, .43]	$p = .003$	2.47, $p = .87$
Peak BAC	453	7	-.16 - .98	.38 [.09, .66]	$p = .01$	14.71, $p = .02$
Frequency of drinking days	2,939	9	.05 - .76	.24 [.06, .41]	$p = .003$	18.77, $p = .02$
Frequency of binge drinking	348	5	-.08 - .96	.35 [-.01, .71]	$p = .03$	10.32, $p = .04$
Composite alcohol consumption measure	664	5	.07 - .64	.17 [.01, .32]	$p = .02$	4.50, $p = .34$
Secondary outcomes						
Problem drinking	2,942	5	-.14 - .42	.04 [-.14, .22]	$p = .33$	13.28, $p = .01$
Negative consequences	2,002	15	-.11 - .48	.06 [-.03, .15]	$p = .09$	8.63, $p = .85$
Multicomponent						
Primary outcomes						
Quantity	26,857	8	-.05 - .40	-.04 [-.06, -.01]	$p = .001$	16.87, $p = .02$
Quantity per drinking day	4,222	5	-.03 - .73	.10 [-.17, .38]	$p = .23$	6.94, $p = .14$
Frequency of binge drinking	27,095	7	-.04 - .52	.09 [-.02, .20]	$p = .06$	20.40, $p = .002$
Secondary outcomes						
Negative consequences	27,729	7	-.14 - .55	.06 [-.08, .20]	$p = .19$	9.40, $p = .15$
Other						
Primary outcomes						
Quantity	1,547	8	-.13 - .27	.14 [.04, .25]	$p = .003$	6.21, $p = .52$
Secondary outcomes						
Negative consequences	426	5	-.19 - .32	.17 [-.02, .36]	$p = .04$	1.79, $p = .77$

			CDIs with the Largest Effects			
Primary outcomes						
Quantity	1,244	15	-.20 - 1.05	.38 [.21, .55]	$p < .001$	28.06, $p = .01$
Quantity per drinking day	313	5	.08 - .37	.24 [.02, .47]	$p = .02$	1.22, $p = .87$
Peak BAC	399	6	-.16 - .98	.33 [.01, .65]	$p = .02$	12.62, $p = .03$
Frequency of drinking days	491	5	.07 - .76	.41 [.13, .68]	$p = .002$	7.41, $p = .12$
Composite alcohol consumption measure	664	5	.07 - .64	.17 [.01, .32]	$p = .02$	4.50, $p = .34$
Secondary outcomes						
Negative consequences	640	8	-.11 - .48	.10 [-.05, .26]	$p = .10$	3.95, $p = .78$

N = total sample size; k = number of evaluations; d = Hedge's unbiased effect size ((1 - (3 / ((4 x N) - 9))) x ($M_{Control} - M_{Intervention}$ / SD_{Pooled})); δ = weighted average effect size

intervention participants were shown to demonstrate the greatest reductions in peak BAC relative to control participants at follow-up. Significant effects under .20 were revealed for quantity per drinking day and negative consequences. The mean between-group difference for frequency of intoxication failed to reach significance. The vast majority of these effects were homogenous with the exception of quantity, frequency of drinking days, and frequency of binge drinking.

Two mean between-group effect sizes were calculated for individual outcomes among non-US students. A significant heterogeneous effect under .20 was observed for quantity. The mean between-group difference in frequency of binge drinking failed to reach significance.

Mean effects were larger for quantity and frequency of binge drinking among US students than non-US students, providing evidence that current CDI evaluations are more efficacious for US students.

5.4.5.2. Year of study. Three mean between-group effect sizes were calculated for CDIs targeting first year undergraduates and ranged between .10 and .22. A small significant heterogeneous effect was shown for quantity, and significant homogeneous effects under .20 for frequency of binge drinking and negative consequences.

The mean between-group effect sizes calculated for CDIs provided to students of all years varied between .03 and .25. Small significant effects were shown for peak BAC and composite alcohol consumption measures, the largest being the former outcome. Significant mean effects under .20 were shown for quantity, peak quantity, average BAC and negative consequences. The mean between-group difference in quantity per drinking day, frequency of drinking days, and frequency of binge drinking failed to reach significance. Most effects were shown to be homogenous with the exception of quantity, and frequency of binge drinking.

The mean between-group effect sizes calculated for quantity, frequency of binge drinking and negative consequences were larger for CDIs among first year students than students of all years. However, given the similar range of mean effects, there does not appear to be an advantage in targeting CDIs at a particular year group.

5.4.5.3. Drinker status. Mean between-group effect sizes for CDIs targeting binge/heavy drinkers varied between .12 and .33. Small significant effects were shown for quantity, peak quantity, peak BAC, and frequency of drinking days. Binge/heavy drinking intervention participants showed the greatest reductions in frequency of drinking days relative to control participants followed closely by peak BAC. Significant effects under .20 were shown for quantity per drinking day, and composite alcohol consumption measures. The mean between-group difference in negative consequences failed to reach significance. Most effects were homogeneous with the exception of quantity, and frequency of drinking days.

Mean between-group effect sizes for CDIs targeting students of all drinker statuses varied between .04 and .36. A small significant effect was shown for peak quantity, and significant effects under .20 were shown for quantity, frequency of drinking days, and negative consequences. The mean difference in quantity per drinking day, and frequency of binge drinking failed to reach significance. The majority of effects were homogenous with the exception of quantity, and frequency of binge drinking.

Given the greater proportion of between-group mean effects above .20 shown for CDIs targeted at binge/heavy drinkers, there is evidence to suggest that these interventions have a larger effect than CDIs targeting at students of all drinker statuses. However, since interventions that target all students (regardless of the amount they drink) are likely to include light drinkers, it is possible that this finding may be partially

explained by floor effects. For example, when examining the average quantity of alcohol consumed at baseline, students that participated in an intervention targeted at all students were shown to consume between a mean of 1.20 and 18.55 drinks per week, while students that participated in an intervention targeted at binge/heavy drinkers were shown to drink between 9.07 and 28.67 drinks per week.

5.4.5.4. Intervention type. Mean between-group effect sizes for CDIs that utilise PNF varied between .04 and .38. Small significant effects were shown for quantity, peak quantity, peak BAC, frequency of drinking days, and frequency of binge drinking. Intervention participants that received personalised normative feedback were shown to demonstrate the greatest reductions in peak BAC relative to control participants followed closely by frequency of binge drinking. A significant effect under .20 was shown for composite alcohol consumption measures. The mean differences in quantity per drinking day, problem drinking, and negative consequences failed to reach significance. The majority of effects were significantly heterogeneous with the exception of peak quantity, composite alcohol consumption measures, and negative consequences.

Mean effect sizes calculated for CDIs that utilize multicomponent programs varied between -.04 and .10. A significant heterogeneous effect under .20 was shown for quantity. However, this effect was negative, indicating that on average, multicomponent interventions were associated with intervention participants consuming a greater quantity of alcohol at follow-up than control participants. The mean difference in quantity per drinking day, frequency of binge drinking, and negative consequences failed to reach significance.

Two mean effect sizes were calculated for CDIs that utilize other intervention techniques. Homogeneous significant effects under .20 were shown for quantity, and negative consequences, the largest being for the latter outcome.

Again, given the greater proportion of between-group effects above .20 shown for CDIs utilising PNF, there is evidence to suggest their advantage over multicomponent program and other CDIs.

5.4.5.4. CDIs with the largest effects. The above findings indicate that CDIs may be most efficacious when utilising PNF with binge/heavy drinking US students. As such, mean between-group effect sizes were calculated for CDI versus AO evaluations that were conducted at US universities/colleges, targeted binge/heavy drinking students and used PNF. As shown in Table 5, these CDIs with the largest effects provide mean effect sizes ranging from .10 to .41. Significant small effects are shown for quantity, quantity per drinking day, peak BAC, and frequency of drinking days. These intervention participants were shown to show greatest reductions in frequency of drinking days relative to control participants followed closely by quantity, and peak BAC. A significant effect under .20 was shown for composite alcohol consumption measures. The mean difference in negative consequences between the intervention and control group at follow-up failed to reach significance.

5.5. Discussion

This systematic meta-analytic review examined the effectiveness of individual-level computer-delivered interventions (CDIs) targeting undergraduate university students. When combining all evaluations that met the inclusion criteria, CDIs were found to have a significant but negligible effect on reducing student drinking compared to control comparisons. Considerable heterogeneity of effect sizes was observed across evaluations. Further planned meta-analyses, separating effects by primary and

secondary outcomes, control condition, outcome measures, and potential moderators, allowed us to identify the most efficacious CDIs, and examine sources of effect size heterogeneity.

In analyses separating effects by primary and secondary outcomes, CDIs were found to be associated with larger reductions in alcohol-consumption measures (i.e., primary outcomes) than alcohol-related consequences or behaviour indicative of alcohol use disorders (i.e., secondary outcomes). Whilst it is useful to examine the effects of a CDI on negative consequences, the primary aim of most interventions is to reduce alcohol consumption. For example, personalised normative feedback interventions (which were the most commonly used in this review) aim to reduce alcohol consumption by correcting perceived normative drinking levels, which are often overestimated by students (Lewis & Neighbors, 2006). As a secondary outcome, the reductions in negative consequences or the culmination of behaviours indicative of alcohol use disorders should follow from a reduction in alcohol consumption, but not necessarily as a direct result of the CDI.

When separating CDI effect sizes by the control condition used, evaluations using an alcohol-related active control (AC-R) were associated with larger between-group differences for all outcomes and primary outcomes, compared to those using an assessment-only (AO) control condition. This finding was surprising, as it would be expected that an inactive assessment-only control condition should draw out larger between-group differences than an active control containing alcohol-related content. It is possible that these larger effects may reflect a backlash effect (i.e., those in the control condition drinking more following their assigned study protocol than CDI participants), similar to that demonstrated by Jessop and Wade (2008) in their study examining the effect of fear appeals on binge drinking behaviour. The majority of the

alcohol-related active control conditions utilised alcohol education that presented information, statistics, and facts regarding the effects of alcohol consumption. Such mortality-related drinking information has been shown to increase drinking behaviour (Jessop & Wade, 2008).

Importantly, the effect sizes for evaluations using an AC-R control condition were also homogeneous whilst the effect sizes for evaluations using an AO control condition were significantly heterogeneous. This indicates that effects for the latter type of control condition evaluation vary greatly, and in certain situations (possibly due to other study characteristics), CDI versus AO effects may be larger than the CDI versus AC-R effects. This was illustrated when further division of effect sizes by individual outcomes revealed that CDI versus AO control condition evaluations had a slightly larger range of mean effects, and produced a greater number of consistent significant meaningful effect sizes than CDI versus AC-R evaluations.

Dividing the analyses further showed that effects also vary according to the outcome measure used to evaluate the CDI, and that the heterogeneity observed in all outcomes, primary outcomes, and specifically in CDI versus AO evaluations were driven by a few of the individual outcomes. The quantity of alcohol consumed showed particularly marked heterogeneity. The category of quantity outcomes included average and total measures of alcohol consumed over a specified time. The specified period of time, unit of measurement, and questionnaire used to gather this data varied between studies. For example, Bewick et al. (2010) used the total number of units consumed over the last week using a retrospective 7-day drinking diary, while Walters et al. (2009) asked participants to consider a typical week in the previous month, and estimate the number of drinks they consumed each day. This heterogeneity in methodology to assess the quantity of alcohol consumed may explain some of the variability shown. As

such, future research could separate analyses by more specific types of quantity outcomes.

The exploratory analyses of CDI characteristics associated with the largest effects indicated that interventions conducted in the US were more efficacious than those conducted elsewhere, that CDIs targeting heavy/binge drinking students had larger effects than CDIs that targeted students of all drinking statuses, and that CDIs utilizing PNF were more successful at reducing alcohol consumption than multicomponent and other types of CDI. Analyses of CDI versus AO evaluations that met such criteria yielded some of the largest effects in the meta-analysis, confirming the efficacy of such interventions. Unfortunately, effects could only be calculated for two individual outcomes for studies conducted with non-US students. This reflects the heavy dominance of US-based research in this field and highlights the need for more CDI evaluations in other countries to allow for more informative comparisons. However, as discussed previously, it is possible that interventions are more effective with US students due to the legal repercussions of alcohol consumption for under 21 year olds.

Carey et al. (2012) also found CDIs targeting heavier drinkers to be more efficacious than those provided to students of all drinking statuses. Such findings relate to observations made by Rose (1985) in that population-level interventions are likely to be associated with smaller effects for the individual than interventions that target those most at-risk. However, due to the majority of the population not being at-risk, population-wide interventions may produce greater benefits overall.

In this study, the combination of heavy/binge drinking status and the use of PNF were found to be particularly effective. Personalised normative feedback with heavy drinking students is likely to be associated with greater normative misperceptions and

self-other discrepancies than among lighter drinkers and as such, theoretically produce these greater effects. However, paradoxically, heavier drinkers are also likely to have peers that also drink heavily, and as such, dismiss population norms as being inaccurate for their peers.

Although a variety of multicomponent CDIs are utilised in the US (see Walters, Miller, & Chiauzzi, 2005), they were associated with very low between group effect sizes and larger quantities of alcohol consumed at follow-up relative to control conditions. This finding has important implications for current practice in US universities/colleges.

Although, the effect sizes observed in this meta-analysis were small or negligible (according to Cohen's benchmarks), the between-group differences in alcohol-related outcomes found in this study are comparable to the effects of health behaviour interventions calculated in a meta-synthesis (d_+ = .08 - .45; Johnson, Scott-Sheldon & Carey, 2010) and are also largely consistent with those calculated in previous relevant meta-analyses (i.e., Carey et al., 2009, 2012). Whilst Cohen's (1988) guidelines are useful in the interpretation of effect sizes, the use of arbitrary benchmarks to quantify contextually specific effects has been heavily criticised (e.g., Ferguson, 2009). As computer-based interventions represent a cost-effective approach to behaviour change that can be widely distributed, even small effects may have the potential to make a notable impact upon the student population.

Our analyses have highlighted the influence of methodological variability in this literature on the heterogeneity of observed effect sizes. So, how effective CDIs appear to be in reducing student drinking depends on how effectiveness is measured. Specifically, type of control comparisons and type of outcome measures generate differences in effect sizes.

The use of different control conditions may arise because evaluations seek to answer different research questions. For example, assessment-only control conditions are used to examine whether an intervention is better than providing no intervention at all whilst using an alcohol-related active control is utilised to determine whether an intervention is more effective than providing students with existing (usual care) alcohol-related information or providing the same intervention in a different mode of delivery. Previous relevant meta-analyses have focused on the use of one particular control group (Carey et al., 2012) or like our own review, categorised different control conditions and analysed effects separately (Carey et al., 2009). However, our review shows that careful consideration needs to be taken in categorising control conditions. Assessment-only and alcohol-relevant active controls, combined in analyses presented by Carey et al. (2009) were found to generate different ranges of effect sizes.

Arguably, delayed assessment-only control groups should be used to determine whether interventions are better than providing no intervention at all or at least as an additional control group due to the possible effects of mere measurement (i.e., behaviour change due to behaviour-related questioning; Sprott et al., 2006). Only two of the intervention evaluations included in this study used delayed assessment-only conditions and whilst one study showed little difference in effect sizes when using CDI versus AO or CDI versus DAO (Bendtsen et al., 2012), the other showed greater between-group differences for the delayed assessment-only condition evaluation (Hester et al., 2012).

The use of different outcome measures also needs to be given careful consideration in future. Nineteen different types of outcome were observed and effect sizes were found to differ accordingly, clarifying that, in this field of inquiry, intervention effectiveness depends on how you measure effectiveness. There is

currently no “gold-standard” assessment for alcohol intervention evaluations making comparisons across studies difficult or meaningless. It is important to establish which particular alcohol-related behaviour patterns are of interest in student CDI evaluation and how these patterns are best measured to encourage consistency of measurement across studies.

Importantly, every CDI evaluation in this study uses self-reported measures of alcohol consumption behaviour and, whilst the use objective measures such as biological markers are associated with their own limitations (Adler, 2013), the advances in this field may be beneficial to establishing intervention efficacy in the future. For example, urine based biochemical liver function tests have been shown to corroborate self-reported alcohol consumption (Jain, Quraishi, Majumder & Pattanayak, 2013) and fatty acid ethyl esters in hair have been used as a biological marker for excessive alcohol consumption with fairly high accuracy (Auwärter et al., 2001).

Whilst this study lends some support to the efficacy of CDIs in reducing student alcohol in certain contexts and for particular target groups, there are limitations that should be considered when interpreting the findings. First, the self-report measures used in the reviewed evaluations are subject to a number of biases. Second, for the purpose of parsimony, a single follow-up session for each CDI evaluation was examined, using the assessment nearest to the median follow-up time of 8 weeks. As such, results discussed above should be considered as an evaluation of short-term effects of CDI efficacy. It should be noted that if an alternative follow-up time was used, the effect sizes might have differed. Future analysis could consider outcomes at different follow-up points as these have been shown to produce different effects in previous research (Carey et al., 2012). Finally, whilst inferences were made regarding the source of some of the observed heterogeneity in calculated effect sizes, some of the variability still remains

unaccounted for. It is possible that potential moderators not examined in this analysis such as the duration of the intervention, number of sessions, demographic characteristics and intervention components may help to explain this heterogeneity.

The findings of this study suggest that in general, CDIs are associated with reductions in a variety of alcohol-related outcome measures but these reductions are generally small or very small. The largest reductions were observed for alcohol consumption measures compared to alcohol-related consequences or behaviours indicative of alcohol use disorders. While initial analyses revealed great heterogeneity for the effects of CDIs when compared to assessment-only control conditions, further investigation showed consistent meaningful effects for a number of individual outcome measures. Exploratory analyses also identified some characteristics of the CDIs associated with the largest effects, indicating that personalised normative feedback interventions with heavy/binge drinking US students are currently the most effective application of computer-delivered interventions among students.

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Chapter 6

General Discussion

This thesis has presented four studies designed to inform alcohol-related intervention development among UK undergraduate students. The studies employed three research approaches. While the studies have a number of limitations, their results have important practical and theoretical implications. Moreover, the findings can be used to provide recommendations for future research and alcohol-related intervention development and evaluation, and can also be considered within the wider context of intervention and prevention strategies in the UK.

6.1. Summary of Main Findings

Study 1. The results of study 1 showed that self-reported positive alcohol-related outcome expectancies provided at baseline were significantly positively correlated with self-reported craving ratings. Higher positive expectancy ratings were also associated with higher volumes of alcohol consumed during a taste-test. These findings provided support for the role of positive, but not negative, alcohol-related outcome expectancies in cognitive models of craving. Bolstering negative expectancies and contradicting positive expectancies using an imagery script was associated with reduced mild desires immediately following the manipulation but higher perceived loss of control over limiting drinking following the consumption of cider in a taste-test.

Study 2. The findings of study 2 provided limited support for the results of study 1. Although the negative script manipulation was associated with immediate reductions in craving ratings, the observed effects were small and failed to reach statistical significance. The changes in outcome expectancies in the expected direction following repeated exposure to the manipulation also failed to reach significance. No

other notable effects of the manipulation were observed. Both study 1 and study 2 failed to show manipulation effects on alcohol consumption.

Study 3. The findings of study 3 showed that a large number of the alcohol use determinants identified in the previous US dominated alcohol research were also applicable to a UK undergraduate student population. Twenty-six variables were shown to significantly correlate with level of risk associated with alcohol consumption in our sample of first year undergraduate students. Using hierarchical multiple regression analysis, key determinants were identified. Students with the highest levels of risk related to their alcohol consumption began drinking regularly at an earlier age (age at onset), had higher levels of the sensation-seeking personality trait, drank for social reasons, had low confidence in their ability to drink within government guidelines (self-efficacy), and perceived their university friends to frequently drink high levels of alcohol. Age at onset and the sensation-seeking personality trait represent stable determinants that can be used to identify which first year students may need to be targeted. Social drinking motives, self-efficacy, and normative beliefs regarding university friends' drinking behaviour, represent determinants that may be amenable to change through intervention. These six variables were able to explain 58% of the variance in level of risk associated with drinking (AUDIT score), and beta coefficients indicated that self-efficacy and social drinking motives made the greatest contribution to the model. A significant interaction between age at onset and self-efficacy explained a further 4% of the variance in AUDIT scores and indicated that the level of risk among individuals with low-self efficacy, who began drinking at an early age, may be particularly problematic.

Study 4. The findings of study 4 showed that, overall, computer-delivered interventions (CDIs) used among the student population have a significant but very low

and heterogeneous between-group effect on alcohol-related outcome measures. Further analysis indicated that CDIs were associated with greater effects on primary outcomes (i.e., alcohol consumption behaviour) than secondary outcomes (i.e., alcohol-related problems and behaviour indicative of dependence), and performing separate meta-analyses by the control condition and outcome measure used, showed effect sizes to vary greatly in size and heterogeneity. Surprisingly, CDIs that used active control conditions encompassing alcohol-related content (AC-R) were associated with larger effect sizes than CDIs that utilised assessment-only (AO) controls. However, further dividing meta-analyses by outcome measures revealed that CDI versus AO evaluations were associated with a larger range of mean effects and produced a greater number of consistent significant meaningful effect sizes than CDI versus AC-R evaluations. CDIs were associated with the largest effect sizes for estimated peak blood alcohol content (BAC). Finally, CDIs appeared to be most efficacious when conducted with heavy or binge drinking students in the US and contained personalised normative feedback.

6.2. Limitations

Self-report measures. All four studies draw conclusions from self-report questionnaires. Consequently, the findings are subject to response biases. While self-report measures of alcohol consumption have generally been validated using collateral reports (Babor, Steinberg, Anton, & Del Boca, 2000), breath analysis (Cherpitel, 1989), and biological markers (Mundle, Ackermann, Günthner, Munkes, & Mann, 1999), self-reported measures of psychological determinants such as alcohol-related outcome expectancies and drinking motives are difficult to objectively verify. However, the moderate to high levels of internal reliability observed for most questionnaire measures used in these studies does at least suggest internal consistency in responses.

Furthermore, for within-subject analyses of change (such as in study one and two), this limitation may not be as influential as in between-subjects analyses.

Lack of Internal Consistency for Loss of Control Items. Studies 1 and 2 demonstrated that the two loss of control items used in the Desires for Alcohol Questionnaire (Love, James, & Willner, 1998) lacked internal consistency. As a result subsequent analyses were conducted on the two separate items. While the use of single-item measures can have the advantage of simplicity, multi-item scales are more sensitive to changes over time and provide a more reliable profile of a multidimensional behaviour (Bowling, 2005; McHorney, Ware, Rogers, Raczek, & Lu, 1992). Consequently, the findings relating to loss of control in these studies need to be considered with caution.

Lack of Statistical Power. Studies 1 and 2 used small sample sizes, and as a result, lacked statistical power in detecting significant results. The pattern of results observed may have been substantiated had larger sample sizes been used for these two studies. Study 4 also demonstrated that the vast majority of intervention evaluations compiled in the meta-analysis lack statistical power as only two were shown to have significant effect sizes when considering all outcomes. Future research should ensure that a priori power analyses are conducted to ensure that evaluations of intervention and manipulation have enough power to detect significant phenomenon.

Laboratory settings. Laboratory-based studies (study 1 and 2) are useful in examining underlying mechanisms, and inferring cause and effect following manipulations. However, they may not reflect behaviour in a naturalistic setting. This is particularly important when examining alcohol consumption, which is contextually specific (e.g., Clapp & Shillington, 2001; Clapp, Shillington, & Segars, 2000; Demers et al., 2002), and alcohol-related outcome expectancies, which are also shown to vary in

strength according to drinking situations (MacLatchy-Gaudet & Stewart, 2001). As such, these findings should be considered as a preliminary investigation into behaviour change techniques that would need to be translated into intervention strategies.

Identification of key determinants. Survey-based research (study 3) helps to identify the key determinants of alcohol use that may be amenable to change but does not inform us on how these may be modified. Translating key determinants into theory-based behaviour change techniques is perhaps one of the greatest challenges for intervention development. Moreover, whilst determinants may be amenable to change and associated with self-reported alcohol consumption, they may not be reflected in alcohol consumption behaviour (as in study 1 and 2). As such, effective behaviour change techniques, based on theory-based psychosocial determinants of health behaviour (e.g., Abraham & Michie, 2008), need to be identified and standardized.

Heterogeneity. Meta-analyses enable us to draw conclusions regarding the effectiveness of previously examined interventions. However, as is evident in study 4, intervention evaluations show great heterogeneity. While the CONSORT (Consolidated Standards of Reporting Trials) and TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) statements have been designed to improve the reporting of randomized- (Moher, Schulz, & Altman, 2001) and non-randomised trials (Des Jarlais, Lyles, & Crepaz, 2004), there is currently no "gold-standard" recommendations for the design and assessment of alcohol intervention evaluations. As such, intervention evaluations use a variety of control groups and alcohol-related outcome measures, making comparisons across studies difficult or meaningless.

6.3. Practical and Theoretical Implications

Cognitive models of craving. The bivariate correlation results from study 1 provide support for the role of positive expectancies in cognitive models of craving

(e.g., Tiffany, 1999). Drug-related cues are thought to activate positive expectancies regarding the effects of the drug and influence craving. Positive expectancies were significantly associated with craving and alcohol consumption measures. No significant associations were observed between negative alcohol-related outcome expectancies and craving ratings. Consequently, these findings provide support for the outcome-expectancy model (Tiffany, 1999), which postulates that positive, but not negative, expectancies have a role in craving.

Craving is amenable to change. Results from study 1 also showed that craving might be amenable to change using a negative expectancy-based manipulation. Drug-related craving has been previously manipulated using drug-related cues (Kilgus & Pumariega, 1994), attentional bias retraining (Field & Eastwood, 2005), mood induction (Willner & Jones, 1996), and imagery scripts containing craving-related content (Tiffany & Drobes, 1990). A previous study has also demonstrated that exposure to alcohol-related cues is associated with increased craving, increased expectancies regarding the pleasant effects of alcohol, and decreased cognitive impairment expectancies (Cooney, Gillespie, Baker, & Kaplan, 1987). Study 1 contributes to these findings by demonstrating the relationship between craving and expectancies using an expectancy-based manipulation rather than a craving-based manipulation.

Expectancies are challenging to change. Finally, studies 1 and 2 showed that repeated exposure to an alcohol-expectancy manipulation over the course of a week was not associated with significantly greater effects than single-exposure. Expectancy theory encompasses principles of social learning theory (Bandura, 1977). Consequently, these alcohol-related beliefs are thought to continually develop through learned and/or personal experiences of the associations between alcohol, and positive and negative behavioural and emotional consequences. Alcohol-related outcome expectancies are

shown to be evident in children as young as 8 years old (Miller, Smith, & Goldman, 1990) and likely to continue to develop through adolescence and adulthood. Modifying beliefs that have developed over such a long period of time is likely to be challenging and as such, may require more intensive interventions than those presented in this thesis.

Key determinants of level of risk associated with alcohol consumption. The parsimonious model of level of risk associated with alcohol consumption among UK first year undergraduate students presented in study 3 identifies alcohol use determinants that inform intervention targeting and content strategies. First year undergraduate students who began regularly drinking at an earlier age and show higher levels of the sensation-seeking personality trait represent a particular group that may benefit most from intervention. Modifying social drinking motives, self-efficacy for moderating consumption and normative perceptions regarding university friends' drinking behaviour within an intervention should also produce beneficial effects.

Age at onset. Lower age at onset has been consistently associated with increased alcohol consumption behaviour (Grant & Dawson, 1997; Grant et al., 2006; Hingson, Heeran, & Winter, 2006; Pitkanen, Lyyra, & Pulkkinen, 2005), and delaying onset has been associated with reducing the prevalence of alcohol dependence and abuse (Grant & Dawson, 1997). Consequently, these provide support for the use of early prevention methods to suspend the beginning of regular drinking and/or targeting those who began drinking at an earlier age. Specifically, the results from study 3 indicated that suspending the offset of alcohol consumption until the age of at least 16 years old (one standard deviation above the mean age of onset observed in this study) might have beneficial effects regarding the level of risk associated with alcohol consumption.

Sensation-seeking. The sensation-seeking personality trait has also been consistently associated with alcohol consumption (Borsari, Murphy, & Barnett, 2007; Grange, Jones, Erb, & Reyes, 1995; Grau & Ortet, 1999), and pre-screening school students high in sensation-seeking for intervention has been shown to be cost effective and associated with positive results (Conrod, Castellanos, & Mackie, 2008; Conrod, Stewart, Comeau & Maclean, 2006). Furthermore, Palmgreen, Donohew, Lorch, Hoyle, and Stephenson (2001) have developed the sensation-seeking targeting (SENTAR) prevention approach which states that sensation-seeking be used as a targeting variable and that prevention messages be designed using high-sensation-value and placed in high-sensation-value contexts. This approach has been effective in preventing marijuana use in high sensation-seeking adolescents (Palmgreen et al., 2001; Stephenson et al., 2002). As such, the findings of study 3 suggest that targeting high sensation-seeking drinkers may be beneficial and/or messages used within interventions should be designed to appeal to sensation-seekers.

Drinking motives. Enhancement, social, and coping drinking motives have been found to be consistently associated with consumption levels and alcohol-related problems in previous research (Lyvers, Hasking, Hani, Rhodes, & Trew, 2010; Martens, Rocha, Martin, & Serrao, 2008; Simons, Correia, & Carey, 2000; Yusko, Buckman, White, & Pandina, 2008). Study 3 found social motives to be a key predictor of level of risk related to alcohol consumption. Drinking motives are considered to be psychosocial determinants of alcohol use that mediate the relationship between alcohol-related outcome expectancies and alcohol use (Kuntsche, Knibbe, Engels, & Gmel, 2007). Individuals are unlikely to be motivated to drink for social reasons if they do not expect alcohol to have socially enhancing effects on their behaviour. As such, drinking motives can be considered to be proximal predictors of consumption that reflect distal

expectancies of alcohol effects. As shown in studies 1 and 2, alcohol-related outcome expectancies are challenging to manipulate. However, as a key determinant, social motives, and arguably, expectations should be addressed within intervention design.

Self-efficacy. Self-efficacy has been shown to mediate the relationship between health knowledge and behaviour, with higher knowledge-behaviour correlations observed among those with higher self-efficacy (Rimal, 2000). This determinant has also been shown to be amenable to change, and increases are related to positive changes in health behaviour (Strecher, McEvoy DeVellis, Beck, & Rosenstock, 1986). As a result, increasing an individual's confidence in their ability to moderate alcohol consumption within government guidelines should have beneficial effects on their alcohol consumption. In order to drink within government guidelines (2-3 units per day for women, 3-4 units per day for men) individuals need to show a good understanding of unit measurement. As indicated from the preliminary interviews, this is particularly relevant to students, as a large proportion of their drinking is reported to take place in halls of residences, where the standardised measures used in licensed premises are not available. De Visser and Birch (2012) have shown that young people have a lack of unit knowledge; participants were shown to underestimate the unit content of alcoholic beverages and usually consumed drinks containing more than one unit. Consequently, practical strategies to increase unit knowledge such as a drink-pouring task (de Visser & Birch, 2012) should be included in interventions among the UK student population to aid self-efficacy boosting components for drinking moderation.

Normative beliefs. US based alcohol-related research has positioned normative beliefs as one of the most important influences on alcohol consumption (Borsari & Carey, 2001; 2003). In translating this determinant into an intervention strategy, research has used personalised normative feedback (PNF) to correct misperceived high

levels of alcohol consumption as 'normal' and to provoke self-other discrepancies by highlighting an individuals drinking to be higher than their peers. This is thought to motivate a reduction in subsequent consumption. PNF interventions, which have generally been shown to be effective (e.g., Walters & Neighbors, 2005) were the most commonly used type of CDI in study 4 and also shown to be one of the components of the CDIs shown to have the largest effects. Normative beliefs regarding university friends' drinking behaviour were identified as a key determinant of level of risk related to drinking in study 3. Consequently, these beliefs should be targeted within interventions for UK students.

CDIs with the Largest Effects. Among US student populations, the most effective CDIs were those that used PNF and targeted students that reported binge drinking or heavy drinking behaviour (i.e., those most at risk). CDIs matching such criteria showed significant between-group effects for primary outcome measures that ranged between $\delta = .17$ and $\delta = .41$, with the largest effect sizes being demonstrated for frequency of drinking days, quantity of alcohol consumed and peak estimated blood alcohol content (BAC). As such, these CDIs were effective in reducing the number of occasions students consumed alcohol, the amount they drank over a specified period of time and the maximum amount they drank per occasion. Such findings demonstrate that as a relatively cost-effective intervention approach; CDIs show promise for reducing alcohol consumption in the student population, CDIs should be targeted at those most at risk and that PNF may be an effective behaviour change technique to include within intervention content.

6.4. Future Directions

Validation of craving findings. Studies 1 and 2 provided support for the role of positive expectancies in cognitive models of craving (e.g., Tiffany, 1999). Changes in

self-reported craving ratings have been demonstrated following a negative imagery script manipulation. However, due to the nature of self-report measures and the proposed definitions of craving that also encompass "behavioural, physiological, and neurochemical correlates" (Markou et al., 1993, p.176), further research should aim to validate such changes using alternative measures of craving such as those discussed by Sayette et al. (2000). For example, changes in self-reported craving should be reflected in psychophysiological responses (e.g., heart rate, skin temperature, blood pressure, skin conductance, salivation), neurobiological responses (e.g., regions associated with emotional and cognitive aspects of memory), or cognitive processing abilities (e.g., performance in divided attention tasks).

Craving coping skills. The outcome-expectancy model (Tiffany, 1999) positions craving as an underlying mechanism that may mediate the relationship between expectancies and alcohol consumption. Study 1 demonstrated the relationship between positive outcome-expectancies and alcohol consumption, and positive outcome-expectancies and craving, but not craving and alcohol consumption. Changes in craving were immediate following the manipulation and were not evident over a longer period of time. As craving is shown to be contextually specific and thought to activate in response to alcohol-related cue exposure, further research should be conducted to examine whether the manipulation related changes in alcohol-related craving are evident when participants are presented with alcohol-related stimuli, and whether student participants would benefit from being trained to recognise and quash positive expectancies and craving when exposed to cues. The latter suggestion relates strongly to coping skills that may be taught to treatment seeking, alcohol dependent populations as described by Kadden and colleagues (1995). While coping skills are usually taught to increase the likelihood of abstinence, they may be adaptable to

teaching students to abstain on at least two consecutive days per week (as recommended by the government drinking guidelines) and/or to moderate consumption when they are drinking. However, students would need to be highly motivated to learn such skills. According to Larimer, Palmer, and Marlatt's (1999) cognitive-behavioural model of relapse prevention, clients should learn to recognise high-risk situations associated with strong urges to drink to be able to prepare evasive action, or apply taught behavioural or cognitive coping skills such as drink refusal strategies and assertive communication skills. Consequently, it would be predicted that highly motivated students might show reduced alcohol use following coping skills training.

Identifying effective behavioural change techniques that target modifiable key determinants. By identifying the key determinants of level of risk associated with alcohol consumption among a first year undergraduate population in study 3, a clear path for future research has been established. First, as this questionnaire study was conducted on one UK university campus, it is necessary to validate the findings by conducting a similar study across multiple UK campuses as drinking patterns are shown to differ according to geographical region (Lifestyle Statistics, Health and Social Care Information Centre, 2013). Second, in identifying the potential modifiable determinants of level of risk related to drinking, further research is necessary to review and identify behavioural change techniques that may be most effective in reducing level of risk in this population. For example, while personalised normative feedback (PNF) interventions (as described above) have generally been shown to be effective in (predominately US) student populations (e.g., Walters & Neighbors, 2005), the overall effect sizes calculated for UK-based computer-delivered PNF interventions presented in study 4 were either detrimental (d = -.17; Bewick et al., 2010) or very small (d = .07; Bewick, Trusler, Mulhern, Barkham & Hill, 2008; d = .01; Moreira, Oskrochi &

Foxcroft, 2012). Future research should establish why this technique might not be successful in a UK student population and consider alternative approaches to modifying normative beliefs regarding university friends' alcohol consumption.

In the preliminary interviews, alcohol use was viewed very positively. Playing drinking games was associated with trying to "stitch-up" friends into drinking more alcohol and one student even described a score chart in her flat that recorded the number of times each flat-mate had been sick as a result of drinking. The competitive side to drinking in this population may explain why highlighting to a student that they drink more than their peers could be an ineffective approach within intervention for a UK student population. Moreover, for young men in particular, drinking stamina may be considered as a positive personal attribute as it has been associated with the construction of masculine identity (de Visser & Smith, 2007). Personalised normative feedback is likely to either produce no effect on alcohol consumption or produce detrimental effects (i.e., increased drinking) for students that view drinking stamina to be a positive attribute.

As study 3 has shown that drinking behaviour among university friends in particular rather than the typical student influences alcohol use, an alternative intervention approach may be to target drinking cliques or groups of friends at university. While interventions have been previously disseminated among groups of students (e.g., LaBrie, Hummer, Neighbors & Pedersen, 2008; McNally & Palfai, 2003), these groups tend to be determined by the researcher rather than by the formation of friendship circles. Performing alcohol-related interventions with the drinking cliques identified by student participants may be expected to produce more beneficial results on alcohol use than conducting interventions with individuals or groups defined by the researcher.

Increasing the UK university intervention evidence-base. While reviewing CDIs among the student population in study 4, it was clearly evident that the literature is heavily dominated with US studies. Further university-based intervention evaluations must be conducted within the UK to provide an evidence-base that is culturally specific. CDI efficacy with UK students could only be assessed from four published articles that presented six CDI versus AO evaluations. In addition to the three PNF evaluations mentioned above (Bewick et al., 2008; Bewick et al., 2010; Moreira et al., 2012) that demonstrated low or detrimental effect sizes, the other three CDI versus AO evaluations were presented in an article by Hagger, Lonsdale and Chatzisarantis (2012). This study utilized relatively novel CDI components compared to the remaining literature and examined the effects of a computer delivered mental simulation task and implementation intention task, mental simulation task only and implementation intention task only versus AO. The mental simulation task asked participants to visualise achieving the goal of keeping their alcohol consumption within safe limits and imagine how they would feel in that situation. The implementation intention task asked participants to formulate two "*if…then…*" plans to achieve the goal of drinking within safe limits while taking into consideration specific situations in which they may be most likely to drink above safe limits. For example, "*If* I am in a bar/pub drinking with my friends and I am likely to drink over the daily safe limits for alcohol, *then* I will opt for a soft drink instead of an alcoholic drink to keep within the recommended safe limits" (p.27). Our analyses showed that the mental simulation only was associated with the largest effect size (d = .20), followed by the mental simulation and implementation intention condition (d = .18) and finally, the implementation intention only condition (d = -.01). As such, the mental simulation intervention component was associated with a small effect size while the implementation intention component was associated with no

effect. Across all six UK-based CDI evaluations, this mental simulation component is associated with the largest effects and as such, warrants further research.

Consideration of readiness to change. The studies presented here focus on the determinants of alcohol consumption and how these may be modified. However, importantly, a large majority of the student population do not recognize the need to change their alcohol consumption behaviour (Vik, Culbertson, & Sellers, 2000) or show ambivalence towards their drinking (de Visser & Smith, 2007). This is a barrier that needs to be examined in greater depth as without motivation to change their behaviour, these change techniques are unlikely to be effective.

6.5. Intervention Design and Evaluation Recommendations.

Based on these findings, it is recommended that UK university-based intervention design encompass strategies to challenge social drinking motives and alcohol-related outcome expectancies, bolster self-efficacy to moderate drinking behaviour, and target normative beliefs regarding university friends' drinking behaviour. Interventions may also benefit from incorporating practical strategies to increase unit knowledge and coping strategies to tackle craving following exposure to alcohol-related cues. Interventions may be most effective when targeted at students that started drinking at an earlier age, show high levels of the sensation-seeking personality trait and report heavy or binge drinking behaviour. While computer-delivered interventions may show some potential for reducing alcohol consumption, more extensive interventions may be necessary to challenge engrained alcohol-related beliefs such as alcohol-related outcome expectancies and drinking motives, which will have developed over time.

As demonstrated in these studies, a large number of different measures are currently used to evaluate alcohol use among this population. Measures utilised in this

thesis include the AUDIT, AUQ, and daily drinking diaries. Other studies reviewed have included many more. The AUQ and daily drinking diaries have demonstrated their utility in measuring habitual alcohol use and previous weekly consumption. However, in study 1, the AUDIT could be differentiated from the AUQ by the significant correlation observed with loss of control over drinking. Consequently, this measure is recommended for use in future studies and intervention evaluations, as it appears to be sensitive to risk levels of drinking behaviour among this population.

Careful consideration must be given regarding the choice of control group used to evaluate manipulation or intervention effectiveness in randomised control group designs. As shown in study 4, the choice of control group is associated with different effect sizes and, as shown in study 2, an active control group may demonstrate unintended reactivity. Whilst the choice of control group will depend upon the research question being examined (i.e., is an intervention more effective than no intervention, an alternative intervention or usual care?), the inclusion of assessment-only and/or delayed assessment-only control conditions to examine intervention efficacy is recommended. In using both control conditions, reactivity to the measurement of alcohol consumption behaviour (mere-measurement effects) and the effects of the intervention can be examined, and importantly, it provides the ability to differentiate between the two.

6.5. UK Population Prevention and Intervention Strategies

While this thesis focuses on individual level alcohol intervention and behaviour change, NICE (2010) recommends the use of both population and individual approaches to reduce alcohol-related harm and the current government have highlighted a number of strategies that aim to tackle this issue (HM Government, 2012). A number of these policies have the potential to affect students drinking behaviour. Through policy, the government stated that they would aim to reduce the availability of cheap alcohol and

drink promotions using a minimum price per unit and a ban on multi-buy promotions. However, the minimum pricing plan has since been shelved and the ban on multi-buy promotions has since been rejected (BBC News, 2013). These policies would make little impact on the pub trade (most drinking establishments already sell above the minimum price of 45p per unit). However, they may affect off-license/supermarket alcohol sales, which in turn, may have a considerable impact upon the student population who report drinking or pre-drinking alcohol in halls of residences or student housing to save money. Furthermore, recent research indicates that that 18-24 year olds' alcohol consumption may be more influenced by pricing than older people (Cook et al., 2011).

The second initiative of the recent alcohol strategy (HM Government, 2012) that may influence student drinking behaviour is the power now being given to local agencies to challenge alcohol use in their local area. Since April 2013, local authorities have been entitled to a public health grant to fund local alcohol services designed to meet local needs. Students should be considered as a specific population within the local community that may benefit from various local-level tools such as the power to control opening and closing times of local businesses, reviewing alcohol licence applications and controlling the density of alcohol outlets.

In addition to the policies adopted by local authorities, universities should consider the use of their own university-level strategies to discourage excessive drinking such as restricting alcohol availability on-campus. Due to the association between academic workload and alcohol consumption (e.g., Tremblay et al., 2010), another option that could affect first year students drinking behaviour in particular that may be considered is increasing the academic consequences of first year study (i.e., by making at least some first year grades contribute to overall degree result).

6.6. Conclusion

Despite the extensive research conducted on alcohol use among undergraduate students, an effective intervention strategy for widespread dissemination in UK universities is yet to be established. The findings presented within this thesis highlight the psychosocial determinants that universities could potentially modify within intervention strategies (i.e., social drinking motives, self-efficacy, university friends' descriptive normative drinking behaviour), and identifies those students that may be drinking at particularly risky levels (i.e., those that began drinking at an earlier age and have high levels of the sensation seeking personality trait). Computer-delivered interventions may offer a potentially cost-effective approach to reduce alcohol among this population and the findings from the two laboratory-based studies demonstrate that a variety of alcohol-related cognitions can be measured via computer and email. Furthermore, with the continuing growth of modern technology, researchers can develop novel techniques (such as those used in studies 1 and 2) to target potentially modifiable determinants. However, modifying alcohol-related beliefs that develop through personal experience might require more extensive intervention approaches. Further intervention evaluations should be conducted to determine which behaviour change techniques, and which modes of delivery, will most effectively reduce consumption behaviour based upon the evidence-base surrounding these identified psychosocial determinants.

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Appendices

Appendix A

Items from the Online Screening Questionnaire

This questionnaire is investigating your alcohol consumption behaviour. All answers you provide are strictly confidential. We only need to know your email address so we can contact you if you are eligible for the main study. We will not link your answers to you personally, and all records of email addresses will be destroyed once contact has been made, or if you are not eligible for the study.

While we appreciate your help, we also recognise that you have the right to withdraw from completing this questionnaire at any time and the right to withdraw your data up to the point of publication.

Please make sure that you have read and understood the above information before completing the questionnaire. In completing the following questions, you are providing informed consent to participate in this initial questionnaire, and for us to contact you if you are eligible to participate in the main study.

Please answer all the questions as honestly and as accurately as possible. The following information may be useful in answering some of the questions: -

Premium strength lager e.g. Stella Artois, Kronenbourg, Grolsch	**1 pint = 2.8 units**
Standard lager e.g. Carlsberg, Fosters, Carling	**1 pint = 2.3 units**
Standard beer/bitter e.g. Harvey's	**1 pint = 2 units**
Alcopop e.g. WKD, Smirnoff ice	**275 ml bottle = 1.4 units**
Regular cider e.g. Strongbow, Magner's	**1 pint = 2.8 units**
Wine (alc 12% vol) small pub glass	**175 ml = 2.1 units**
Wine (alc 12% vol) large pub glass	**250 ml = 3 units**
Gin/Vodka/Rum (alc 35% vol)	**25 ml measure = 0.9 units**
Whisky/Bourbon/Brandy (alc 40% vol)	**25 ml measure = 1 unit**

Please consider your drinking behaviour in answering the following questions. Select the most appropriate response.

How often do you have a drink containing alcohol?

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

How many units of alcohol do you drink on a typical day when you are drinking?

1 -2	3 – 4	5 – 6	7 – 9	10+

How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you found that you were not able to stop drinking once you had started?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you failed to do what was normally expected from you because of your drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you had a feeling of guilt or remorse after drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you been unable to remember what happened the night before because you had been drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

Have you or somebody else been injured as a result of your drinking?

No	Yes, but not in the last year	Yes, during the last year

Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down

No	Yes, but not in the last year	Yes, during the last year

The following questions ask you about your habitual use of various types of alcoholic drinks. Please consider your own drinking in the average week for the last six months when answering the questions. Take your time to give an accurate answer to each question.

On how many days per week do you drink wine (at least one small glass)? _____

On the days you drink wine; about how many glasses (pub measure) do you drink?_____

How many glasses (pub measure) of wine do you have in a week, in total? _____

On how many days per week do you drink beer (at least half a pint)?_____

On the days you drink beer, about how many pints do you typically have?_____

How many pints of beer do you drink in a week, in total?_____

On how many days per week do you drink cider (at least half a pint)?_____

On the days you drink cider, about how many pints do you typically have?_____

How many pints of cider do you drink in a week, in total?_____

On how many days per week do you drink spirits (whisky, vodka, gin etc)?_____

On the days you drink spirits, about how many shots (25ml) do you typically have?_____

How many drinks of spirits do you have in a week, in total?_____

On how many days per week do you drink alcopops (Smirnoff Ice, WKD etc.)?_____

On those days you drink alcopops, about how many bottles do you typically have?_____

How many bottles of alcopops do you have each week, in total?_____

When you drink, how fast do you drink? (Here, a drink is a glass of wine, a pint of beer/cider, or a shot of spirits, straight or mixed). Please tick the correct response.

7 or more drinks per hour
6 drinks per hour
5 drinks per hour
4 drinks per hour
3 drinks per hour
2 drinks per hour
1 drink per hour

How many times have you been drunk in the last 6 months? (We mean experiencing some or all of the following: loss of co-ordination, nausea, and/or slurred speech, or blackout)

It may help to consider how many times you get drunk per month and then multiply this by six.

_____

When drinking, what percentage of the time do you end up getting drunk? (For example, if you get drunk half of the time that you drink any alcohol then the answer would be 50%)

_____

Please rate the following alcoholic beverages according to how much you enjoy the taste.

	Like				Dislike
Wine	1	2	3	4	5
Beer	1	2	3	4	5
Cider	1	2	3	4	5
Spirits	1	2	3	4	5
Alcopops	1	2	3	4	5

Please rate the following soft drinks according to how much you enjoy the taste.

	Like				Dislike
Water	1	2	3	4	5
Fruit Juice	1	2	3	4	5
Fruit Cordial/Squash	1	2	3	4	5
Cola	1	2	3	4	5
Lemonade	1	2	3	4	5

Are you male or female?

Male Female

How old are you? _____

What is your year of study?

First Year Undergraduate Student	Second Year Undergraduate Student	Third Year Undergraduate Student	Postgraduate Student

What is your email address?_____

Thank you very much!

Appendix B

Nuffield Hospitals Medical History Questionnaire
CONFIDENTIAL

Please complete all sections of this form unless otherwise indicated.

Name (Full).....

Date of Birth..... Sex…… Height..... Weight.....

Please underline the appropriate answer where a **'Yes'** or **'No'** is required. If your answer is **'Yes'** brief details should be given.

1. Have you suffered from any of the following?

		Details
Diabetes Mellitus	**Yes / No**	
Epilepsy	**Yes / No**	
Frequent chest, throat or nose infections/diseases	**Yes / No**	
Back injury/backache	**Yes / No**	
Joint injury	**Yes / No**	
Ear infection	**Yes / No**	
Rheumatism or Rheumatic fever	**Yes / No**	
Urinary problems or kidney disease	**Yes / No**	
Infectious diseases (Mumps, Measles, German Measles, Tuberculosis etc.)	**Yes / No**	
Hepatitis	**Yes / No**	
Heart disease	**Yes / No**	
High blood pressure, chest pain, shortage of breath	**Yes / No**	
Anxiety or Depression requiring treatment	**Yes / No**	
Nervous breakdown or debility arising from overwork	**Yes / No**	
Menstrual problems	**Yes / No**	
Haemorrhoids	**Yes / No**	
Dyspepsia or Peptic Ulcer	**Yes / No**	
Hernia	**Yes / No**	

Dysentry/Typhoid/Food poisoning	**Yes / No**
Any other stomach disorder	**Yes / No**
Varicose veins	**Yes / No**
Migraines or other frequent headaches	**Yes / No**
Hay fever, eczema or other allergies	**Yes / No**
Skin disorders	**Yes / No**
Fainting or giddiness	**Yes / No**
Poor eyesight (even when wearing glasses/contact lenses)	**Yes / No**
Please give date when eyesight was last tested (approx.)	**Yes / No**
Impaired hearing	**Yes / No**

---

2. Are you a registered disabled person? **Yes / No** If **'Yes'** what is you registration number and expiry date?

---

3. a) Have you been an in-patient in hospital or consulted your GP during the last five years? **Yes / No** If **'Yes'** please give details:

b) How many days of sickness have you had in the last 12 months? What were the main causes?

c) Are you taking any pills, tablets or having injections, receiving any medical or psychiatric treatment or advice or awaiting surgery? **Yes / No** If **'Yes'** please give details:

---

4. How often do you visit your dentist? When was your last visit?

---

5. What was the date of your last immunisation against the following: (approx.)

Tetanus

Tuberculosis

Polio

Rubella (German Measles)
(Anti-D Gammaglobulin)

Hepatitis B

---

6. Date of last x-ray Reason for x-ray

---

7. General state of health; please comment on any aspects not covered above (i.e. accidents, injuries, disorders not mentioned).

8. What is your average consumption of a) alcohol units* per week (* A unit = single measure of spirit / one glass of wine / half a pint of beer)

b) tobacco per day

9. Is there any additional information regarding your health not covered in the above questions?

I declare that the answers given to the above questions are true to the best of my knowledge and I have not withheld any material facts which may have any bearing as to the state of my health.

Signature……Date……

Appendix C

Comprehensive Effects of Alcohol Questionnaire

This questionnaire is interested in people's expectations of alcohol. Please answer the following questions by selecting the most appropriate response (1 = disagree to 7 = agree).

If I were under the influence from drinking alcohol.....

	Disagree						**Agree**
I would feel courageous	1	2	3	4	5	6	7
I would have difficulty thinking	1	2	3	4	5	6	7
I would act tough	1	2	3	4	5	6	7
I would act sociable	1	2	3	4	5	6	7
I would be clumsy	1	2	3	4	5	6	7
I would feel energetic	1	2	3	4	5	6	7
I would feel shaky or jittery the next day	1	2	3	4	5	6	7
I would feel calm	1	2	3	4	5	6	7
My writing would be impaired	1	2	3	4	5	6	7
I would take risks	1	2	3	4	5	6	7
I would be humorous	1	2	3	4	5	6	7
My problems would seem worse	1	2	3	4	5	6	7
I would feel sexy	1	2	3	4	5	6	7
I would feel brave and daring	1	2	3	4	5	6	7
I would act aggressively	1	2	3	4	5	6	7
It would be easier to talk to people	1	2	3	4	5	6	7
I would feel dizzy	1	2	3	4	5	6	7
I would feel self-critical	1	2	3	4	5	6	7
My senses would be dulled	1	2	3	4	5	6	7

I would feel creative	1	2	3	4	5	6	7
I would feel peaceful	1	2	3	4	5	6	7
My responses would be slow	1	2	3	4	5	6	7
I would be outgoing	1	2	3	4	5	6	7
I would neglect my obligations	1	2	3	4	5	6	7
I would enjoy sex more	1	2	3	4	5	6	7
I would feel unafraid	1	2	3	4	5	6	7
I would be loud, boisterous, or noisy	1	2	3	4	5	6	7
I would feel dominant	1	2	3	4	5	6	7
My head would feel fuzzy	1	2	3	4	5	6	7
It would be easier to express feelings	1	2	3	4	5	6	7
I would be friendly	1	2	3	4	5	6	7
I would be a better lover	1	2	3	4	5	6	7
My body would feel relaxed	1	2	3	4	5	6	7
I would feel guilty	1	2	3	4	5	6	7
I would be talkative	1	2	3	4	5	6	7
I would feel moody	1	2	3	4	5	6	7
It would be easier to act out my fantasies	1	2	3	4	5	6	7
I would feel powerful	1	2	3	4	5	6	7

Appendix D

Desires for Alcohol Questionnaire

This questionnaire is interested in how you feel about drinking alcohol at this moment. Please answer the following questions.

	Strongly Disagree						**Strongly Agree**
I want a drink so much I can almost taste it	1	2	3	4	5	6	7
Drinking would be pleasant now	1	2	3	4	5	6	7
If I started drinking now I would be able to stop	1	2	3	4	5	6	7
I would feel less worried about my daily problems if I drank now	1	2	3	4	5	6	7
I would consider having a drink now	1	2	3	4	5	6	7
I am going to drink as soon as I possibly can	1	2	3	4	5	6	7
I would feel as if all the bad things in my life had disappeared if I drank now	1	2	3	4	5	6	7
Drinking would be satisfying now	1	2	3	4	5	6	7
I would accept a drink now if it was offered to me	1	2	3	4	5	6	7
Drinking now would make me feel less tense	1	2	3	4	5	6	7
I would do almost anything to have a drink now	1	2	3	4	5	6	7
I could easily limit how much I would drink if I drank now	1	2	3	4	5	6	7
Even major problems in my life would not bother me if I drank now	1	2	3	4	5	6	7

My desire to drink now seems overwhelming	1	2	3	4	5	6	7

Appendix E

Profile of Mood States Questionnaire

Please read each word below, and decide how much it represents how you feel right now.

	Not at all				**Extremely**
Friendly	1	2	3	4	5
Tense	1	2	3	4	5
Happy	1	2	3	4	5
Angry	1	2	3	4	5
Worn out	1	2	3	4	5
Unhappy	1	2	3	4	5
Confused	1	2	3	4	5
Lively	1	2	3	4	5
Unable to conc	1	2	3	4	5
Sorry for things done	1	2	3	4	5
Shaky	1	2	3	4	5
Listless	1	2	3	4	5
Overjoyed	1	2	3	4	5
Peeved	1	2	3	4	5
Agreeable	1	2	3	4	5
Sad	1	2	3	4	5
Active	1	2	3	4	5
On edge	1	2	3	4	5
Grouchy	1	2	3	4	5
Fatigued	1	2	3	4	5
Muddled	1	2	3	4	5
Blue	1	2	3	4	5
Energetic	1	2	3	4	5

Spiteful	1	2	3	4	5
Hopeless	1	2	3	4	5
Satisfied	1	2	3	4	5
Panicky	1	2	3	4	5
Helpful	1	2	3	4	5
Unworthy	1	2	3	4	5
Annoyed	1	2	3	4	5
Cheerful	1	2	3	4	5
Exhausted	1	2	3	4	5
Resentful	1	2	3	4	5
Forgiving	1	2	3	4	5
Discouraged	1	2	3	4	5
Relaxed	1	2	3	4	5
Bewildered	1	2	3	4	5
Sluggish	1	2	3	4	5
Uneasy	1	2	3	4	5
Kindly	1	2	3	4	5
Lonely	1	2	3	4	5
Miserable	1	2	3	4	5
Efficient	1	2	3	4	5
Bitter	1	2	3	4	5
Pleased	1	2	3	4	5
Alert	1	2	3	4	5
Ready to fight	1	2	3	4	5
Restless	1	2	3	4	5
Good-natured	1	2	3	4	5
Gloomy	1	2	3	4	5
Desperate	1	2	3	4	5
Rebellious	1	2	3	4	5

Nervous	1	2	3	4	5
Helpless	1	2	3	4	5
Weary	1	2	3	4	5
Elated	1	2	3	4	5
Forgetful	1	2	3	4	5
Deceived	1	2	3	4	5
Full of pep	1	2	3	4	5
Warm-hearted	1	2	3	4	5
Carefree	1	2	3	4	5
Furious	1	2	3	4	5
Uncertain	1	2	3	4	5
Worthless	1	2	3	4	5
Anxious	1	2	3	4	5
Vigorous	1	2	3	4	5
Terrified	1	2	3	4	5
Good-tempered	1	2	3	4	5
Guilty	1	2	3	4	5
Bushed	1	2	3	4	5
Bad-tempered	1	2	3	4	5
Refreshed	1	2	3	4	5

Appendix F

Imagery Rating Scale

How well were you able to imagine yourself in the scenario that you have just listened to? (Please circle the most appropriate response)

Not at all						**Extremely Well**
1	2	3	4	5	6	7

How well were you able to relate to the scenario that you have just listened to? (Please circle the most appropriate response)

Not at all						**Extremely Well**
1	2	3	4	5	6	7

How positive or negative did you find the scenario that you have just listened to? (Please circle the most appropriate response)

Extremely Negative						**Extremely Positive**
1	2	3	4	5	6	7

Appendix G

Positive Imagery Script (Female)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go to a student night in Brighton and ask you if you want to come along. You explain that you are worried about the coursework you have due in next week and they say that a night out is exactly what you need. You think about it and decide that having a few drinks tonight will definitely help you to relax after such a stressful day.

In order to save some money, you and your flat mates gather in the kitchen to drink alcohol before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. However, you have begun to form some in-jokes from the drunken behaviour displayed during the first weeks of term. An hour goes by and you feel tipsy; conversation is flowing easily and everyone is laughing and having a good time. You notice that the alcohol levels are beginning to run low and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the night club.

The music is loud and you can feel the bass vibrating through your body. The dance floor is packed and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the bar and one of them suggests that you all do a shot of tequila together. You now feel a bit drunk and follow your friends onto the dance floor. The tequila has taken its effect and you dance confidently with no inhibitions. You exchange banter with one of your flat mates and laugh as he imitates your dance style. Still giggling, you pout and push him playfully in the chest.

Two of your flat mates come back from the bar with another shot of tequila for everyone. After finishing your shot, you approach a guy from your course who is

smiling at you from the bar. The alcohol has given you more confidence, makes you feel turned on and eases your ability to strike up a conversation. You have a lot in common and laugh at each others jokes. He seems like a nice guy with a great sense of humour and you find him very attractive. Before returning to his friends on the dance floor, you exchange numbers and he leans over to kiss you. In the taxi on the way home with your friends you're relaxed and glad that you came out. A night of drinking has really taken your mind off work, you feel a growing connection with your flat mates and to top it all, you had the courage to approach the guy from your course.

Positive Imagery Script (Male)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go to a student night in Brighton and ask you if you want to come along. You explain that you are worried about the coursework you have due in next week and they say that a night out is exactly what you need. You think about it and decide that having a few drinks tonight will definitely help you to relax after such a stressful day.

In order to save some money, you and your flat mates gather in the kitchen to drink alcohol before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. However, you have begun to form some in-jokes from the drunken behaviour displayed during the first weeks of term. An hour goes by and you feel tipsy; conversation is flowing easily and everyone is laughing and having a good time. You notice that the alcohol levels are beginning to run low and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the night club.

The music is loud and you can feel the bass vibrating through your body. The dance floor is packed and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the bar and one of them suggests that you all do a shot of tequila together. You now feel a bit drunk and follow your friends onto the dance floor. The tequila has taken its effect and you dance confidently with no inhibitions. You exchange banter with one of your flat mates and laugh as you mock each other. Still smiling, you pretend to square up to him and push him in the chest.

Two of your flat mates come back from the bar with another shot of tequila for everyone. After finishing your shot, you approach the girl from your course that is smiling at you from the bar. The alcohol has given you more confidence, makes you feel turned on and eases your ability to strike up a conversation. You have a lot in common and laugh at each others jokes. She seems like a nice girl with a great sense of humour and you find her really attractive. Before returning to her friends on the dance floor, you exchange numbers and she leans over to kiss you. In the taxi on the way home with your friends you're relaxed and glad that you came out. A night of drinking has really taken your mind off work, you feel a growing connection with your flat mates and to top it all, you had the courage to approach the girl from your course.

Appendix H

Negative Imagery Script (Female)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go to a student night in Brighton and ask you if you want to come along. You think about it and decide to go along even though you know that having a few drinks tonight will give you a hangover and make you less productive tomorrow.

In order to save some money, you and your flat mates gather in the kitchen to drink alcohol before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. Some good nights out have been spoilt by embarrassing drunken behaviour displayed during the first weeks of term. An hour goes by and you feel tipsy; you're dizzy and find that you're more clumsy than usual. You notice that the alcohol levels are beginning to run low and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the night club.

The music is loud and you can feel the bass vibrating through your body. The dance floor is packed and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the bar and one of them suggests that you all do a shot of tequila together. You now feel a bit drunk and follow your friends onto the dance floor. The tequila has taken its effect and you experience a wave of nausea and stagger as you start to dance. You exchange banter with one of your flat mates but take offence and feel self-conscious and stupid as he imitates your dance style. Unable to control your anger you push him aggressively in the chest and shout at him.

Two of your flat mates come back from the bar with another shot of tequila for everyone. After finishing your shot, you approach a guy from your course who is

smiling at you from the bar. The alcohol has made it difficult to follow conversation and you're slurring your words. He struggles to comprehend what you're saying and you realise how unattractive your behaviour is. He seems like a nice guy but you're drunker than him. Before returning to his friends on the dance floor he tells you to go home and sleep it off. Your cheeks flush red with embarrassment and you lose your confidence. In the taxi on the way home with your friends you're tense and regret coming out at all. A night of drinking will give you a hangover tomorrow, you mistook the banter with your flat mate as malicious and got inappropriately angry at him and, to top it all, you humiliated yourself in front of the guy from your course.

Negative Imagery Script (Male)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go to a student night in Brighton and ask you if you want to come along. You think about it and decide to go along even though you know that having a few drinks tonight will give you a hangover and make you less productive tomorrow.

In order to save some money, you and your flat mates gather in the kitchen to drink alcohol before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. Some good nights out have been spoilt by embarrassing drunken behaviour displayed during the first weeks of term. An hour goes by and you feel tipsy; you're dizzy and find that you're more clumsy than usual. You notice that the alcohol levels are beginning to run low and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the night club.

The music is loud and you can feel the bass vibrating through your body. The dance floor is packed and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the bar and one of them suggests that you all do a shot of tequila together. You now feel a bit drunk and follow your friends onto the dance floor. The tequila has taken its effect and you experience a wave of nausea and stagger as you start to dance. You exchange banter with one of your flat mates but take offence and feel like he's making you look stupid in front of everyone. Unable to control your anger you push him aggressively in the chest and shout at him.

Two of your flat mates come back from the bar with another shot of tequila for everyone. After finishing your shot, you approach a girl from your course that is smiling at you from the bar. The alcohol has made it difficult to follow conversation and you're slurring your words. She struggles to comprehend what you're saying and you realise how unattractive your behaviour is. She seems like a nice girl but you're drunker than her. Before returning to her friends on the dance floor, she tells you to go home and sleep it off. Your cheeks flush red with embarrassment and you lose your confidence. In the taxi on the way home with your friends you're tense and regret coming out at all. A night of drinking will give you a hangover tomorrow, you mistook banter with your flat mate as malicious and got inappropriately angry at him and, to top it all, you humiliated yourself in front of the girl from your course.

Appendix I

Neutral Imagery Script (Female)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go out and meet some other friends in a café in Brighton and ask you if you want to come along. You explain that you are worried about the coursework you have due in next week but after talking through all of your concerns with them, you realise that everyone feels the same way as you do and begin to feel better. You think about it and decide to go with them to the café; it won't take a long time to get there on the bus.

In order to save some money, you and your flat mates gather in the kitchen to eat some food before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. However, you are sure that you will begin to feel comfortable in their company in time. An hour goes by and you feel full; the food you prepared together has satisfied your hunger. You notice that everyone seems to have finished their dinner and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the café.

The music is on and you can hear snippets of other customers' conversations around you. The café is busy and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the counter and one of them suggests that you all get your drinks in the largest available size. You have a sip of your drink and follow your friends to a table near the window. The drink is a rich dark brown colour and smells strong and familiar. You have a conversation with one of your flat mates and discuss some of the latest news from campus. Still talking, you pour some milk into your drink and stir it in with a teaspoon.

Two of your flat mates come back from the counter with another drink for everyone. After finishing your drink, you approach a girl from your course that is standing at the counter. She recognizes you and you start a conversation about the coursework that you both have due in next week. She gives you some helpful advice and suggests that you meet up tomorrow morning to discuss the work further. Before returning to her friends at their table, she pays for her drink. In the taxi on the way home with your friends you discuss your plans for the weekend. A couple of your flat mates are going to go home for the weekend and the others are planning to stay on campus. You tell them that you haven't decided what your plans are yet.

Neutral Imagery Script (Male)

You've finished lectures for the day and you're feeling anxious about the amount of deadlines that you've been set recently. It's your first term of university and your first piece of coursework is due in next week. You worry that your work will not meet degree level standards and this is beginning to stress you out. When you get back to your flat, you find a group of your flat mates chatting together in the kitchen. They are making plans to go out and meet some other friends in a café in Brighton and ask you if you want to come along. You explain that you are worried about the coursework you have due in next week but after talking through all of your concerns with them, you realise that everyone feels the same way as you do and begin to feel better. You think about it and decide to go with them to the café; it won't take a long time to get there on the bus.

In order to save some money, you and your flat mates gather in the kitchen to eat some food before you go out. You're still getting to know your flat mates properly and don't feel completely at ease with them yet. However, you are sure that you will begin to feel comfortable in their company in time. An hour goes by and you feel full; the food you prepared together has satisfied your hunger. You notice that everyone seems to have finished their dinner and rally everyone together to head into town. The bus journey is quick and before you know it, you've arrived at the café.

The music is on and you can hear snippets of other customers' conversations around you. The café is busy and you recognise a few faces of some other students from the university. You follow the rest of your flat mates to the counter and one of them suggests that you all get your drinks in the largest available size. You have a sip of your drink and follow your friends to a table near the window. The drink is a rich dark brown colour and smells strong and familiar. You have a conversation with one of your flat mates and discuss some of the latest news from campus. Still talking, you pour some milk into your drink and stir it in with a teaspoon.

Two of your flat mates come back from the counter with another drink for everyone. After finishing your drink, you approach a guy from your course that is standing at the counter. He recognizes you and you start a conversation about the coursework that you both have due in next week. He gives you some helpful advice and suggests that you meet up tomorrow morning to discuss the work further. Before returning to his friends at their table, he pays for his drink. In the taxi on the way home with your friends you discuss your plans for the weekend. A couple of your flat mates are going to go home for the weekend and the others are planning to stay on campus. You tell them that you haven't decided what your plans are yet.

Appendix J

Ethics Certificate of Approval (DDKA0111)

Life Sciences & Psychology Cluster based Research Ethics Committee	
CERTIFICATE OF APPROVAL	
Reference Number:	DDKA0111
Title of Project:	The impact of bolstering positive and negative alcohol-related expectancies on alcohol-related cognitions and consumption
Principal Investigator:	Dora Duka
Student:	Katie Atwell
Collaborators:	
Duration of Approval (not greater than 4 years)	6 months
Expected Start Date:*	January 2011

This project has been given ethical approval by the Life Sciences and Psychology Cluster based Research Ethics Committee (C-REC).

*NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol.

- Any changes or amendments to approved protocols must be submitted to the C-REC for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects

- Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the C-REC.

The principal investigator is required to provide a brief annual written statement to the committee, indicating the status and conduct of the approved project. These reports will be reviewed at the annual meeting of the committee. A statement by the Principal Investigator to the C-REC indicating the status and conduct of the approved project will be required on the following date(s):

December 2011……

Authorised Signature	Jennifer Rusted
Name of Authorised Signatory (C-REC Chair or nominated deputy)	**Jennifer Rusted**
Date	21-01-2011

Appendix K

Taste Ratings Form

We would like you to rate your drink on pleasantness and strength of taste. Please indicate on the below lines how pleasant, and strong you feel your drink tastes.

Drink as much of the beverage as you want and make your ratings. You have 3 minutes to make your ratings.

1. How pleasant is your drink?

Unpleasant Pleasant

_____

2. How strong is the taste of your drink?

Tasteless Strong-tasting

_____

Appendix L

Items from the Online Screening Questionnaire

This questionnaire is investigating your alcohol consumption behaviour. All answers you provide are strictly confidential. We only need to know your email address so we can contact you if you are eligible for the main study. We will not link your answers to you personally, and all records of email addresses will be destroyed once contact has been made, or if you are not eligible for the study.

While we appreciate your help, we also recognise that you have the right to withdraw from completing this questionnaire at any time and the right to withdraw your data up to the point of publication.

Please make sure that you have read and understood the above information before completing the questionnaire. In completing the following questions, you are providing informed consent to participate in this initial questionnaire, and for us to contact you if you are eligible to participate in the main study.

Please answer all the questions as honestly and as accurately as possible. The following information may be useful in answering some of the questions: -

Premium strength lager e.g. Stella Artois, Kronenbourg, Grolsch	**1 pint = 2.8 units**
Standard lager e.g. Carlsberg, Fosters, Carling	**1 pint = 2.3 units**
Standard beer/bitter e.g. Harvey's	**1 pint = 2 units**
Alcopop e.g. WKD, Smirnoff ice	**275 ml bottle = 1.4 units**
Regular cider e.g. Strongbow, Magner's	**1 pint = 2.8 units**
Wine (alc 12% vol) small pub glass	**175 ml = 2.1 units**
Wine (alc 12% vol) large pub glass	**250 ml = 3 units**
Gin/Vodka/Rum (alc 35% vol)	**25 ml measure = 0.9 units**
Whisky/Bourbon/Brandy (alc 40% vol)	**25 ml measure = 1 unit**

Please consider your drinking behaviour in answering the following questions. Select the most appropriate response.

How often do you have a drink containing alcohol?

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

How many units of alcohol do you drink on a typical day when you are drinking?

1 -2	3 – 4	5 – 6	7 – 9	10+

How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you found that you were not able to stop drinking once you had started?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you failed to do what was normally expected from you because of your drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you had a feeling of guilt or remorse after drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often during the last year have you been unable to remember what happened the night before because you had been drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

Have you or somebody else been injured as a result of your drinking?

No	Yes, but not in the last year	Yes, during the last year

Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down

No	Yes, but not in the last year	Yes, during the last year

The following questions ask you about your habitual use of various types of alcoholic drinks. Please consider your own drinking in the average week for the last six months when answering the questions. Take your time to give an accurate answer to each question.

On how many days per week do you drink wine (at least one small glass)? _____

On the days you drink wine; about how many glasses (pub measure) do you drink?_____

How many glasses (pub measure) of wine do you have in a week, in total? _____

On how many days per week do you drink beer (at least half a pint)?_____

On the days you drink beer, about how many pints do you typically have?_____

How many pints of beer do you drink in a week, in total?_____

On how many days per week do you drink cider (at least half a pint)?_____

On the days you drink cider, about how many pints do you typically have?_____

How many pints of cider do you drink in a week, in total?_____

On how many days per week do you drink spirits (whisky, vodka, gin etc)?_____

On the days you drink spirits, about how many shots (25ml) do you typically have?_____

How many drinks of spirits do you have in a week, in total?_____

On how many days per week do you drink alcopops (Smirnoff Ice, WKD etc.)?_____

On those days you drink alcopops, about how many bottles do you typically have?_____

How many bottles of alcopops do you have each week, in total?_____

When you drink, how fast do you drink? (Here, a drink is a glass of wine, a pint of beer/cider, or a shot of spirits, straight or mixed). Please tick the correct response.

7 or more drinks per hour
6 drinks per hour
5 drinks per hour
4 drinks per hour
3 drinks per hour
2 drinks per hour
1 drink per hour

How many times have you been drunk in the last 6 months? (We mean experiencing some or all of the following: loss of co-ordination, nausea, and/or slurred speech, or blackout)

It may help to consider how many times you get drunk per month and then multiply this by six.

_____

When drinking, what percentage of the time do you end up getting drunk? (For example, if you get drunk half of the time that you drink any alcohol then the answer would be 50%)

_____

The following questions are interested in your expectations of alcohol. Please answer the following questions by selecting the most appropriate response (1 = disagree to 7 = agree).

If I were under the influence from drinking alcohol.....

	Disagree						**Agree**
I would feel courageous	1	2	3	4	5	6	7
I would have difficulty thinking	1	2	3	4	5	6	7
I would act tough	1	2	3	4	5	6	7

I would act sociable	1	2	3	4	5	6	7
I would be clumsy	1	2	3	4	5	6	7
I would feel energetic	1	2	3	4	5	6	7
I would feel shaky or jittery the next day	1	2	3	4	5	6	7
I would feel calm	1	2	3	4	5	6	7
My writing would be impaired	1	2	3	4	5	6	7
I would take risks	1	2	3	4	5	6	7
I would be humorous	1	2	3	4	5	6	7
My problems would seem worse	1	2	3	4	5	6	7
I would feel sexy	1	2	3	4	5	6	7
I would feel brave and daring	1	2	3	4	5	6	7
I would act aggressively	1	2	3	4	5	6	7
It would be easier to talk to people	1	2	3	4	5	6	7
I would feel dizzy	1	2	3	4	5	6	7
I would feel self-critical	1	2	3	4	5	6	7
My senses would be dulled	1	2	3	4	5	6	7
I would feel creative	1	2	3	4	5	6	7
I would feel peaceful	1	2	3	4	5	6	7
My responses would be slow	1	2	3	4	5	6	7
I would be outgoing	1	2	3	4	5	6	7
I would neglect my obligations	1	2	3	4	5	6	7
I would enjoy sex more	1	2	3	4	5	6	7
I would feel unafraid	1	2	3	4	5	6	7
I would be loud, boisterous, or noisy	1	2	3	4	5	6	7
I would feel dominant	1	2	3	4	5	6	7
My head would feel fuzzy	1	2	3	4	5	6	7
It would be easier to express	1	2	3	4	5	6	7

feelings							
I would be friendly	1	2	3	4	5	6	7
I would be a better lover	1	2	3	4	5	6	7
My body would feel relaxed	1	2	3	4	5	6	7
I would feel guilty	1	2	3	4	5	6	7
I would be talkative	1	2	3	4	5	6	7
I would feel moody	1	2	3	4	5	6	7
It would be easier to act out my fantasies	1	2	3	4	5	6	7
I would feel powerful	1	2	3	4	5	6	7

Are you male or female?

Male Female

How old are you? _____

What is your year of study?

First Year Undergraduate Student	Second Year Undergraduate Student	Third Year Undergraduate Student	Postgraduate Student

What is your email address?_____

Thank you very much!

Appendix M

Example Page from Alcohol Drinking Diary

Please consider the alcohol that you drank between waking up yesterday morning, and before you went to sleep last night/early this morning.

Please use the list of the different types of alcohol, and record the amount you consumed (e.g. 1 bottle, 2 glasses, 5 pints, 3 singles, 7 shots) during the morning, evening, and after midnight.

Drink Type	**AM**	**PM**	**After Midnight**
Spirits			
Red Wine			
White Wine			
Standard Lager/Beer			
Strong Lager/Beer			
Cider			
Alcopops			
Other (Please Specify)			

Were you drunk yesterday/last night? (Please circle) YES / NO

Appendix N

Target and Attribute Words from the Positive Implicit Association Task

Target Words	Attribute Words
JUICE	**relaxed**
COKE	**chatty**
WATER	**sexy**
SPRITE	**sociable**
FANTA	**confident**
TONIC	**fun**
VODKA	**unfriendly**
WINE	**ugly**
CIDER	**boring**
WHISKEY	**withdrawn**
BEER	**cowardly**
GIN	**tense**

Target and Attribute Words from the Negative Implicit Association Task

Target Words	Attribute Words
JUICE	**forgetful**
COKE	**dizzy**
WATER	**remorseful**
SPRITE	**reckless**
FANTA	**aggressive**
TONIC	**clumsy**

VODKA	**content**
WINE	**calm**
CIDER	**coordinated**
WHISKEY	**attentive**
BEER	**focused**
GIN	**careful**

Appendix O

Text Message and Email Content

Diary Reminder Text

"Please remember to complete your alcohol consumption diary, and bring this along to the next session. You will be paid £20 when you have completed all diaries, memory recall tasks, and four sessions. Many thanks"

Diary Reminder Text with Request to Check Email

"Please remember to complete your alcohol consumption diary, and bring this along to the next session. Today, you should also email the researcher with a recollection of the script that you heard during your last session. Please check your email ASAP, and email the researcher back within 24hrs. You will be paid £20 when you have completed all diaries, memory recall tasks, and four sessions. Many thanks"

Email Content

" Thank you for checking your email, as requested by text message. Please write down as much of the script that you can remember, and email this back to the researcher within 24hrs.

You will be paid £20 when you have completed all diaries, memory recall tasks, and four sessions."

Appendix P

Negative Script Recall Score Sheet

1. Finished lectures for the day
2. First piece of coursework due
3. Flat mates making plans
4. Decide to attend a student night
5. Drink alcohol in the kitchen to save money
6. Getting to know flat mates
7. Head to town when alcohol runs low
8. Quick bus journey
9. Anxious
10. Worried
11. Stressed
12. Uneasy
13. Potential hangover
14. Lower productivity
15. Spoilt nights due to embarrassing behaviour
16. Tipsy
17. Dizzy
18. Clumsy
19. Loud music
20. Packed dance floor
21. Recognize other students
22. Head to bar and do a shot of tequila
23. Exchange banter with flat mate
24. Offended
25. Self-conscious
26. Stupid
27. Angry
28. Nausea
29. Stagger
30. Aggressive
31. Given another shot of tequila
32. Approach a guy/girl from your course
33. Drunker than the guy/girl from your course
34. Told to go home and sleep it off
35. Get taxi home
36. Embarrassed
37. Unconfident
38. Tense
39. Unattractive
40. Difficulty with conversation
41. Hangover
42. Misunderstanding
43. Humiliating behaviour

Neutral Script Recall Score Sheet

1. Finished lectures for the day
2. First piece of coursework due
3. Flat mates making plans
4. Talk about work concerns with flat mates
5. Decide to go to café
6. Won't take long to get there on the bus
7. Eat food in the kitchen to save money
8. Getting to know flat mates
9. Head to town when everyone has eaten
10. Quick bus journey
11. Anxious
12. Worried
13. Stressed
14. Feel better about coursework
15. Don't feel at ease with flat mates yet
16. Feel sure you will be comfortable with flat mates in time
17. Full
18. Satisfied hunger
19. Music in on
20. Hear others' conversations
21. Busy café
22. Recognize other students
23. Head to counter to get drink
24. Get drink in largest size
25. Sit at a table near the window
26. Rich brown drink
27. Drink smells string and familiar
28. Talk with flat mates
29. Discuss campus news
30. Add milk and stir
31. Given another drink
32. Approach a guy/girl from your course
33. Recognized by guy/girl from your course
34. Speak to guy/girl about coursework
35. Guy/girl gives helpful advice
36. Guy/girl suggests you meet tomorrow to discuss further
37. Guy/girl pays for drink
38. Guy/girl returns to friends
39. Get taxi home
40. Discuss weekend plans
41. Couple of flat mates going home for the weekend
42. Couple of flat mates staying on campus
43. Undecided on your plans

Appendix Q

Ethics Certificate of Approval (DDKA0411)

Life Sciences & Psychology Cluster based Research Ethics Committee **CERTIFICATE OF APPROVAL**	
Reference Number:	DDKA0411
Title of Project:	The impact of bolstering negative alcohol-related expectancies on alcohol-related cognitions and consumption over the course of a week
Principal Investigator:	Dora Duka
Student:	Katie Atwell
Collaborators:	
Duration of Approval (not greater than 4 years)	6 months
Expected Start Date:*	January 2011

This project has been given ethical approval by the Life Sciences and Psychology Cluster based Research Ethics Committee (C-REC).

*NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:

Amendments to protocol.

- Any changes or amendments to approved protocols must be submitted to the C-REC for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects

- Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the C-REC.

The principal investigator is required to provide a brief annual written statement to the committee, indicating the status and conduct of the approved project. These reports will be reviewed at the annual meeting of the committee. A statement by the Principal Investigator to the C-REC indicating the status and conduct of the approved project will be required on the following date(s):

December
2011……

Authorised Signature	Jennifer Rusted
Name of Authorised Signatory (C-REC Chair or nominated deputy)	**Jennifer Rusted**
Date	21-01-2011

Appendix R

A Questionnaire on First Year Undergraduates Alcohol Consumption at University

This questionnaire investigates alcohol consumption amongst first year undergraduates at Sussex University. Please answer all the questions honestly and return to the researcher as soon as possible. We do not need to know your name. We want to know about drinking patterns amongst students, generally. We will not link your answers to you personally and all records of email addresses will be destroyed after the prize draws. Please try to be as accurate as possible.

We really appreciate you helping us with this research and we are making two £25 prizes available. All those who complete the questionnaire will be entered into a lottery to win these prizes.

While we appreciate your help we also recognise that you have the right to withdraw at any time – and the right to withdraw your data.

Please use the following table when calculating units of alcohol consumption: -

Premium strength lager e.g. Stella Artois, Kronenbourg, Grolsch	**1 pint = 2.8 units**
Standard lager e.g. Carlsberg, Fosters, Carling	**1 pint = 2.3 units**
Standard beer/bitter e.g. Harvey's	**1 pint = 2 units**
Alcopop e.g. WKD, Smirnoff ice	**275 ml bottle = 1.4 units**
Regular cider e.g. Strongbow, Magner's	**1 pint = 2.8 units**
Wine (alc 12% vol) small pub glass	**175 ml = 2.1 units**
Wine (alc 12% vol) large pub glass	**250 ml = 3 units**
Gin/Vodka/Rum (alc 35% vol)	**25 ml measure = 0.9 units**
Whisky/Bourbon/Brandy (alc 40% vol)	**25 ml measure = 1 unit**

Alcohol Consumption before University

How old were you when you first started drinking alcohol (not including small sips or tastes)?

.....

Alcohol Consumption since you began University

How often do you have a drink containing alcohol since you began university? (please circle)

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

How many units of alcohol do you drink on a typical day when you are drinking since you began university?

1 -2	3 - 4	5 - 6	7 - 9	10+

How often have you had 6 or more units if female, or 8 or more if male, on a single occasion since you began university?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often since you began university have you found that you were not able to stop drinking once you had started?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often since you began university have you failed to do what was normally expected from you because of your drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often since you began university have you needed an alcoholic drink in the morning to get yourself going after a heavy drinking session?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often since you began university have you had a feeling of guilt or remorse after drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

How often since you began university have you been unable to remember what happened the night before because you had been drinking?

Never	Less than monthly	Monthly	Weekly	Daily or almost daily

Have you or somebody else been injured as a result of your drinking?

No	Yes, but not since I began university	Yes, since I began university

Has a relative or friend, doctor or other health worker been concerned about your drinking or suggested that you cut down?

No	Yes, but not since I began university	Yes, since I began university

Family Alcohol Consumption

How would you define your mother/female guardian's drinking behaviour? (please circle– leave blank if not applicable)

1 2 3 4 5 6 7

Non-drinker Problem drinker

How would you define your father/male guardian's drinking behaviour? (please circle – leave blank if not applicable)

1 2 3 4 5 6 7

Non-drinker Problem drinker

How would you define your closest (in age) sibling's drinking behaviour? (please circle – leave blank if not applicable)

1 2 3 4 5 6 7

Non-drinker Problem drinker

In general, how much do you think your mother/female guardian approves of adult alcohol consumption? (leave blank if not applicable)

1	2	3	4	5
Strongly disapproves	Disapproves	Neither disapproves or approves	Approves	Strongly approves

In general, how much do you think your father/male guardian approves of adult alcohol consumption? (leave blank if not applicable)

1	2	3	4	5
Strongly disapproves	Disapproves	Neither disapproves or approves	Approves	Strongly approves

In general, how much do you think your closest (in age) sibling approves of adult alcohol consumption? (leave blank if not applicable)

1	2	3	4	5
Strongly disapproves	Disapproves	Neither disapproves or approves	Approves	Strongly approves

Other Drinkers

How often do your university friends have a drink containing alcohol? (please circle)

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

How many units of alcohol do your university friends drink on a typical day when they are drinking?

1 -2	3 - 4	5 - 6	7 - 9	10+

Do you think your university friends approve of how much alcohol you consume?

Definitely no	Probably no	Probably yes	Definitely yes

How often do you think a typical student has a drink containing alcohol? (please circle)

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

How many units of alcohol do you think a typical student drinks on a typical day when they are drinking?

1 -2	3 - 4	5 - 6	7 - 9	10+

Do you think a typical student would approve of how much alcohol you consume?

Definitely no	Probably no	Probably yes	Definitely yes

The following questions concern your images of people. For example, we all have ideas about what a typical grandmother is like. We might think of the typical grandmother as caring, sweet and frail. Of course, not all grandmothers are exactly alike but they may be alike in some ways. Now think about the type of person who binge drinks (a man who drinks more than 3 pints or 6 shorts or a woman who more than drinks 2 pints or 4 shorts in a single session or evening).

How favourable is your impression of the type of person who engages in a binge drinking session at least once a week? (tick one box)

Very unfavourable □ □ □ □ □ □ □ □ □ □ Very favourable

In general, how similar are you to the type of person who engages in a binge drinking session at least once a week? (tick one box)

Not at all similar □ □ □ □ □ □ □ □ □ □ Very similar

Expectations of Alcohol

This questionnaire is interested in people's expectations of alcohol. Please answer the following questions.

If I were under the influence from drinking alcohol.....

	Disagree			**Agree**
I would feel courageous	1	2	3	4
I would have difficulty thinking	1	2	3	4
I would act tough	1	2	3	4
I would act sociable	1	2	3	4
I would be clumsy	1	2	3	4
I would feel energetic	1	2	3	4
I would feel shaky or jittery the next day	1	2	3	4
I would feel calm	1	2	3	4
My writing would be impaired	1	2	3	4
I would take risks	1	2	3	4
I would be humorous	1	2	3	4

	Disagree			**Agree**
My problems would seem worse	1	2	3	4
I would feel sexy	1	2	3	4
I would feel brave and daring	1	2	3	4
I would act aggressively	1	2	3	4
It would be easier to talk to people	1	2	3	4
I would feel dizzy	1	2	3	4
I would feel self-critical	1	2	3	4
My senses would be dulled	1	2	3	4
I would feel creative	1	2	3	4
I would feel peaceful	1	2	3	4
My responses would be slow	1	2	3	4
I would be outgoing	1	2	3	4
I would neglect my obligations	1	2	3	4
I would enjoy sex more	1	2	3	4
I would feel unafraid	1	2	3	4
I would be loud, boisterous, or noisy	1	2	3	4
I would feel dominant	1	2	3	4
My head would feel fuzzy	1	2	3	4
It would be easier to express feelings	1	2	3	4
I would be friendly	1	2	3	4
I would be a better lover	1	2	3	4
My body would feel relaxed	1	2	3	4
I would feel guilty	1	2	3	4
I would feel moody	1	2	3	4
It would be easier to act out my fantasies	1	2	3	4

	Disagree			Agree
I would feel powerful	1	2	3	4

Why do you Drink?

Listed below are 20 reasons people might be inclined to drink alcoholic beverages. Using the five-point scale below, decide how frequently your own drinking is motivated by each of the reasons listed.

YOU DRINK…

	Almost Never / Never	Some of the time	Half of the time	Most of the time	Almost Always / Always
To forget your worries	1	2	3	4	5
Because your friends pressure you to drink	1	2	3	4	5
Because it helps you enjoy a party	1	2	3	4	5
Because it helps you when you feel depressed or nervous	1	2	3	4	5
To be sociable	1	2	3	4	5
To cheer up when you are in a bad mood	1	2	3	4	5
Because you like the feeling	1	2	3	4	5
So that others won't kid you about not drinking	1	2	3	4	5
Because it's exciting	1	2	3	4	5
To get high	1	2	3	4	5
Because it makes social gatherings more fun	1	2	3	4	5
To fit in with a group you like	1	2	3	4	5

	Almost Never / Never	Some of the time	Half of the time	Most of the time	Almost Always / Always
Because it gives you a pleasant feeling	1	2	3	4	5
Because it improves parties and celebrations	1	2	3	4	5
Because you feel more self-confident and sure of yourself	1	2	3	4	5
To celebrate a special occasion with friends	1	2	3	4	5
To forget about your problems	1	2	3	4	5
Because it's fun	1	2	3	4	5
To be liked	1	2	3	4	5
So you won't feel left out	1	2	3	4	5

About You

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
Am always prepared	1	2	3	4	5
Do crazy things	1	2	3	4	5

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
Leave my belongings around	1	2	3	4	5
Act wild and crazy	1	2	3	4	5
Pay attention to details	1	2	3	4	5
Do unexpected things	1	2	3	4	5
Make a mess of things	1	2	3	4	5
Like to act on a whim	1	2	3	4	5
Get chores done right away	1	2	3	4	5
Am easily talked into doing silly things	1	2	3	4	5
Often forget to put things back in their proper place	1	2	3	4	5
Am unpredictable, people never know what I am going to say	1	2	3	4	5
Like order	1	2	3	4	5
Enjoy wild flights of fantasy	1	2	3	4	5
Shirk my duties	1	2	3	4	5
Have persuaded others to do something really adventurous or crazy	1	2	3	4	5

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate
Follow a schedule	1	2	3	4	5
Seek adventure	1	2	3	4	5
Am exact in my work	1	2	3	4	5
Take risks	1	2	3	4	5

How old are you? ……

What is your sex? Male □ Female □

What are you currently studying? .....

What are your current living arrangements?

Living on campus □
Living in university managed accommodation off campus □
Living in privately rented accommodation □
Live with parents/guardians □
Live in my own house □
Other (please specify)
……...

What is your ethnicity?

White □
Mixed □
Indian □
Pakistani □
Bangladeshi □
Other Asian □
Black Caribbean □
Black African □
Other Black □
Chinese □
Other ethnic group (please specify)
.....

What is your religion?

None □
Christian (including Church of England, Catholic, Protestant and all other Christian denominations) □
Muslim □
Hindu □
Sikh □
Jewish □
Buddhist □
Other religion (please specify) ……

How religious a person are you?

Not at all religious	A little religious	More than a little religious	Quite religious	Very religious

How often do you attend religious services?

Never	Monthly or less	2 - 4 times per month	2 - 3 times per week	4+ times per week

UK Government Guidelines

The government currently recommends that men should not exceed 3-4 units of alcohol per day, and that women should not exceed 2-3 units of alcohol per day.

How confident do you feel in your ability to stay within these daily guidelines?

Very confident	Quite confident	Neither confident or unconfident	Quite unconfident	Very unconfident

Please provide your email address so that we can contact you if you win one of the two prize draws worth £25.

E-mail Address .....

Date of Completion .....

Thank you very much for participating

Appendix S

Ethics Certificate of Approval

University of Sussex
School of Life Sciences Research Governance Committee

CERTIFICATE OF APPROVAL

Title of Project	Survey examining predictors, moderators and mediators of alcohol consumption among first year undergraduates
Principal Investigator	Charles Abraham
Student	Katie Atwell
Collaborators	Dora Duka
Duration of approval (not greater than 4 years)	8 months

This project has been given ethical approval by the School of Life Sciences Research Governance Committee.

NB. If the actual project start date is delayed beyond 12 months of the expected start date, this Certificate of Approval will lapse and the project will need to be reviewed again to take account of changed circumstances such as legislation, sponsor requirements and University procedures.

Please note and follow the requirements for approved submissions:
Amendments to protocol.

- Any changes or amendments to approved protocols must be submitted to the committee for authorisation prior to implementation.

Feedback regarding the status and conduct of approved projects

- Any incidents with ethical implications that occur during the implementation of the project must be reported immediately to the Chair of the committee.

The principal investigator is required to provide a brief annual written statement to the committee, indicating the status and conduct of the approved project. These reports will be reviewed at the annual meeting of the committee. A statement by the Principal Investigator to the Committee indicating the status and conduct of the approved project will be required on the following date(s):

December 2009……

Signed: …….. …Jennifer Rusted……..
Chair of the Research Governance Committee

Date: ……9 November 2009…….